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Ventilation of the St. Louis Tunnel.

BY FRANK H. POND.

It was expected when the railroad tunnel leading from the Bridge to Union Depot, in the city of St. Louis, was built, that the openings at Washington avenue, St. Charles and Eighth streets, would be ample to relieve it of the smoke from trains passing through, but the increased number of trains kept the tunnel constantly filled with smoke and dangerous gases, to the great discomfort and annoyance of the traveling public.

Coke-burning locomotives were tried, but the amount of carbonic acid gas was still the same. The use of coke also increased the cost of fuel $100 per month for each locomotive. Another interesting fact might be mentioned in connection with the use of coke. It was found that the blast caused the coke to cut out the tubes in the boiler. This did not show itself until the end of the first three months, after which time the locomotives were constantly in the shops for repairs. After a trial of fifteen months, the use of coke was abandoned, and the idea of ventilating the tunnel by mechanical means was proposed.

This proved a difficult problem to solve, for the tunnel is a double track, double archway passage under the city of St. Louis, connecting the celebrated Ead's Bridge with the Union Depot. It is 5,007 feet long, and has grades varying from 1.37 feet to 0.31 feet per 100. It contains one curve 90 feet in length, and 500 feet radius. There are 272 regular trains per day, and as the locomotives must necessarily go through with full fires and high steam, on account of the curve and the grades, and burning a soft, sulphurous bituminous coal, the tunnel has for some years past been literally choked with smoke to such an extent that it was almost impossible to repair the tracks. The St. Louis Bridge and Tunnel Co. instructed Mr. C. Schaler Smith, their consulting engineer, to try mechanical ventilation. Mr. Smith, assisted by the superintendent of the bridge and tunnel, then spent several months experimenting on large models of various forms of centrifugal fans, air screws, and combined screw and centrifugal machines, and finally reached a conclusion as to the best shape to adopt for this particular case. They also made many trials as to the flow of air-currents in the tunnel, the friction of air at high speeds over various surfaces, etc.

The fan itself, as will be seen from Figs. 4 and 5, in the engraving, consists of a pair of steel cones placed butt to butt, and riveted together. These cones carry the inner blades, 16 in number, three feet wide, and all of soft steel. These again carry a pair of steel annuli, 26″ wide, and having riveted to them the outer set of blades, 32 in number, 16″ wide and shrouded by annuli, 13″ wide. The fan itself is 15 feet diameter and 9 feet wide.

In constructing the fan the following proportions were used: Area of inlet being one area of issues is 0.42, area of final discharge at top of stack, 0.61. The idea is to create a vacuum by the fan, and have the gasses flow in, and after passing through one annulus, the next blade will force them out, and as the area of the final discharge is greater than the issue, the gasses pass off with very little friction.

Referring to the engraving, Fig. 1 shows a sectional view of the tunnel looking endwise; also showing position of fan, engines and boiler. Fig. 2 is a sectional view of tunnel, lengthwise, showing house, fan and shrouding. Fig. 3 is a plan showing position of machinery and shrouding; also the curve of tracks. Figs. 4 and 5 are enlarged views of the fan.

The machinery is located on St. Charles street, near Eighth, exactly at the center of the curve, as shown in Fig. 3. The fan is run by a Herreshoff compound double cylinder non-condensing engine, the maximum capacity of which is 192-horse power. The fan is so nicely adjusted that it requires only one indicated horse-power to run it 28 revolutions per minute. The fan discharges into a stack built of boiler plates, circular in shape, 37 feet diameter at the base, 15 feet at the top, and 130 feet high.

The results obtained have been perfectly satisfactory. Trains run through the tunnel in four minutes, and occupy 1¼ minutes in going from the western entrance to the fan-house. From the time a train passes the fan-house going east, it is 4½ minutes before the tunnel is completely clear of smoke, and the smoke from a west-bound train is exhausted in 3½ minutes from the time the locomotive passes the fan-house. The tunnel is, therefore, clear of smoke from east-bound trains in 6¼ minutes, and from west-bound trains in 5¾ minutes, from the moment either train enters the tunnel. This is with the fan running at 110 revolutions—a speed requiring an expenditure of 56-horse power. At any faster speed the current of air in the western end of the tunnel becomes unpleasantly strong for the repair men.

It is found that 104 revolutions of the fan, requiring 50-horse power, is amply sufficient for the requirements of the present traffic in the tunnel. The fan is run day and night, and the engineers and firemen live in the building erected around the chimney stack.

As the speed of a train exceeds that of a moving body of air, it of course runs, to a certain extent, in its own smoke. The locomotive, however, is usually in clear air, and the smoke cannot accumulate. The total quantity of air to be removed, in order to get clear of the smoke from any one train, is 2,755 000 cubic feet. It was found necessary, in order to secure the best results from this ventilator, to shut up all other ventilating openings, so as to make one closed passage of the entire tunnel.

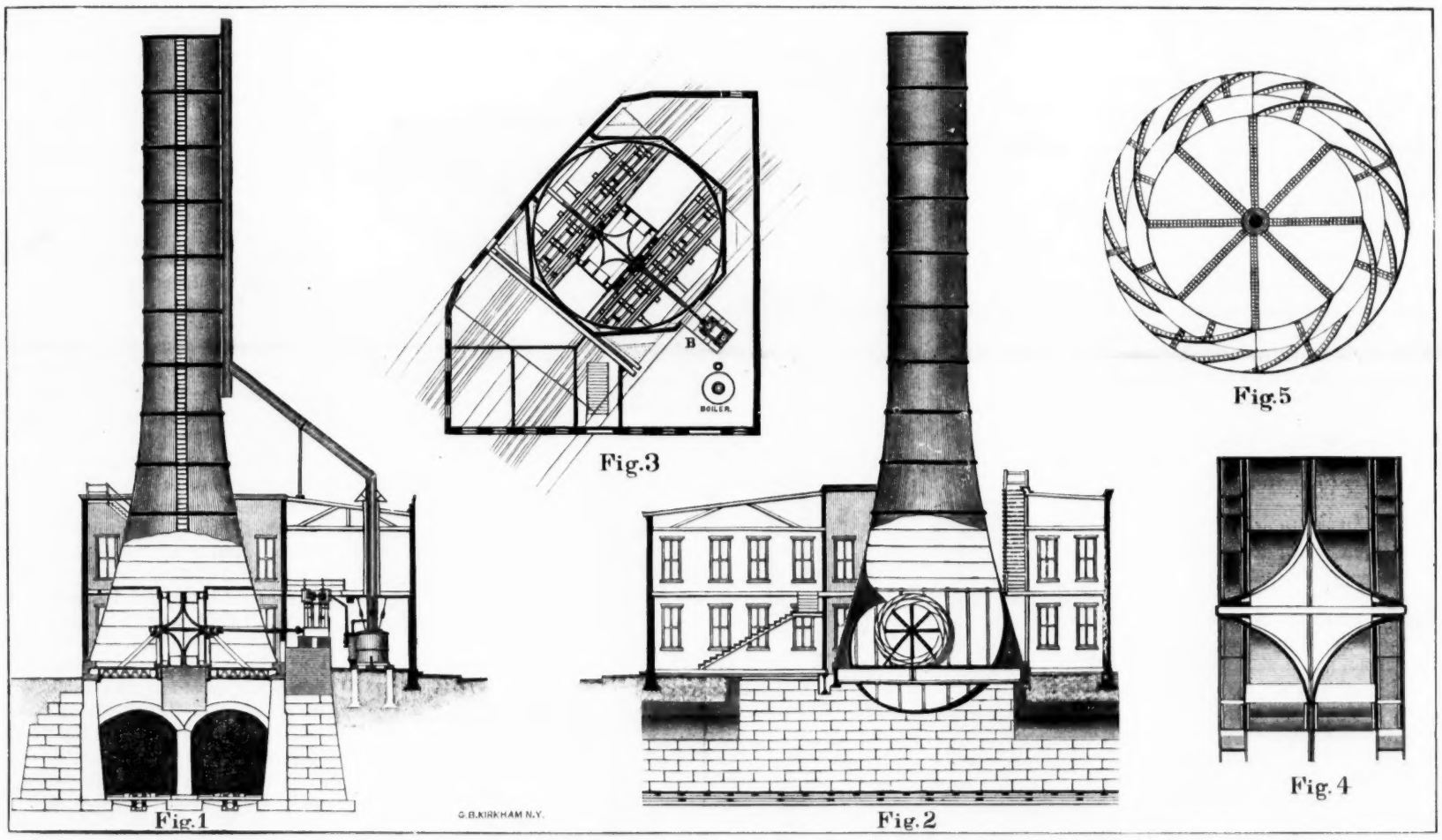


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

METHOD OF VENTILATING A RAILROAD TUNNEL.

The strike of the iron workers in the West continues, and most of the mills are idle. Prices of iron have advanced somewhat, and will probably advance more. Mills that have a stock of iron on hand will of course derive a benefit from the advance, but viewed from an outside standpoint no increase in price can overcome the actual loss to the business of the country at large by the prolonged idleness of so many industrial establishments.

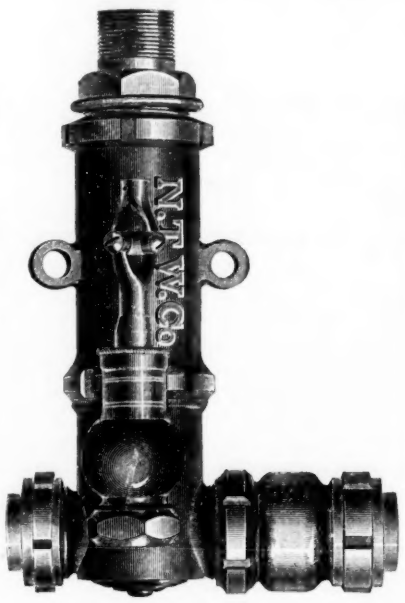
New Lifting and Non-Lifting Injectors.

The engravings presented herewith represent the new or 1882 style of injectors, invented by W. B. Mack, and made by the National Tube Works Co., 8 Pemberton Square, Boston, Mass. The lifting injector consists of an outer shell shown detached by number 1. The mixing nozzle number 2 is fitted inside the shell, and is held in place by the receiving nozzle number 3 being screwed upon the end as shown in the sectional view. The steam nozzle number 4 is also fitted by a ball joint to the shell, and held by the spanner nut number 7. The shell of the steam valve number 5 is screwed fast to the end of the steam nozzle, and by means of the ball joint may be turned up, down or sidewise to suit the direction of the steam pipe. Number 6 represents the steam valve, and number 8 the nut with stuffing-box. By an inspection of the sectional view, number 1, it will be seen that all the internal parts, when worn by use in connection with muddy or sandy water, may be easily removed and new ones substituted, as each of these parts is made to gauges, thus insuring perfect fits.

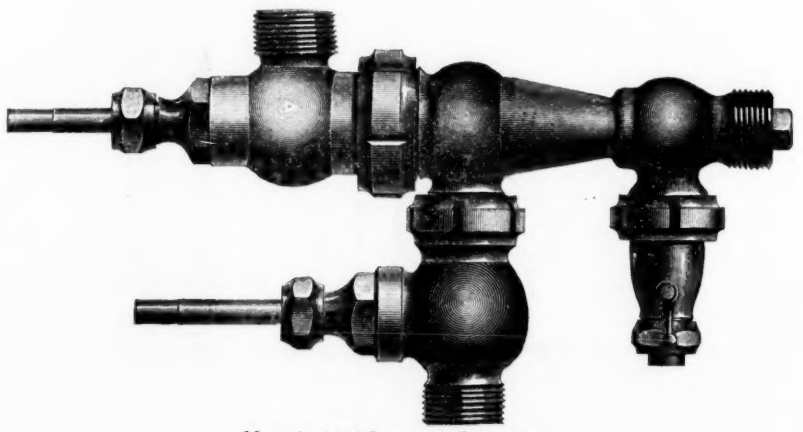
Railroad companies and others using these injectors can keep a stock of duplicate parts on hand, so that when an injector gets out of order through wear, the worn part may be replaced without taking the injector from its position on the engine.

The economical advantages of this construction will readily suggest themselves to the engineer upon an inspection of the engravings. This style is made of gum metal in seven different sizes.

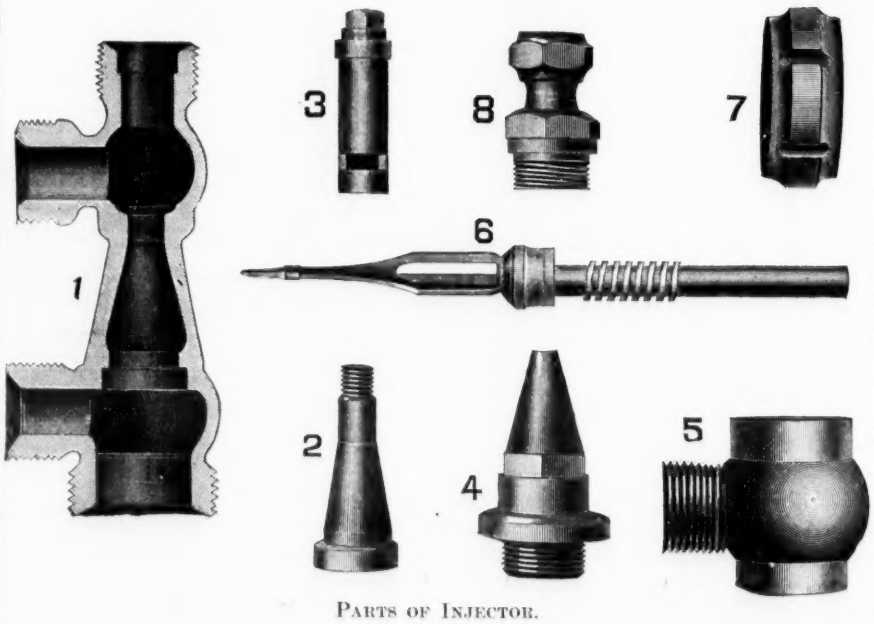
The non-lifting injector also shown, so far as workmanship and duplication of parts is concerned, is identified with the lifting injector just described. The patterns are somewhat different and the feed water must flow through it.



NON-LIFTING INJECTOR.



MACK'S 1882 LIFTING INJECTOR.



PARTS OF INJECTOR.

Belting to Connect Shafts which Neither Intersect nor are Parallel.

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FROM A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS AT PHILADELPHIA, APRIL 21ST, 1882.

This article will consist of a statement of the principles on which the discussion is founded, with a graphical method of finding the correct positions of pulleys on such shafts. It will be treated in a manner somewhat different from that of the paper, and those who do not find it sufficiently mathematical and complete are referred to the original paper as published by the society. Partial tables, sufficiently accurate for making practical tests of this method are also added. [For the engravings, see page 3.]

Figure 1 is an elevation of two horizontal shafts at an angle with each other. The general way in which such a twist belt runs is familiar to all mechanical men. The belt leaves the lower pulley at the "point of departure," Z', and runs in a straight line to the "point of arrival," X, on the upper pulley. This straight line $Z'X$ (the "belt tangent"), is tangent to both lower and upper pulleys; it is also at right angles to the upper shaft, for otherwise the belt would not run in this position on the upper pulley. From X to Y the belt runs in the usual manner in a plane, which we will call the "belt plane," perpendicular to the upper shaft. The belt tangent ZX must, in the same way, lie in the belt plane of the lower pulley, otherwise the belt would not run correctly on this pulley. In fact it is the general law for all flat belting that the "*point of departure*" *of the belt from one pulley must lie in the* "*belt plane*" of the pulley to which the belt runs. From X' to Y' we have another circular arc lying in the lower "belt plane." It is well known to all observers that when the belt leaves the pulleys it does not make an angle edgewise, but pulls off in a curve, to do which the belt must commence slipping sideways at the "slipping points," Y and Y', so that from Y to Z and Y' to Z' the belt follows curved paths on the surfaces of the pulleys, which curves join the circular arcs and belt tangents without any angle, that is, these curves are tangent at one end to the belt arcs and at the other to the belt tangents.

It follows also that while Z' must lie in the belt plane of the upper pulley, *it does not lie in that of the lower*, but at a distance r' to one side of it, and the same is true *vice versa* of Z.

It is also evident that Z *and* Z' *will not in general lie at the same height as the shafts;* for a shaft angle of 90° they will, but for less than 90°, Z' will be below, and Z above, the level of its shaft, and for angles from 90° to 180° the reverse will be true. This fact will be appreciated by noticing in Fig. 1 that while Z is somewhere nearly over Z', X is much nearer to the eye, and the belt tangent slopes towards the eye, as well as to the right so that Z must be lower than the shaft. The ordinary method of setting such pulleys does not take these two facts into account, and is therefore inaccurate, though for shafts widely separated the error is small.

It is shown in the complete paper that if we develop the surfaces of the pulleys with the curves YZ and $Y'Z'$ upon them, these curves will become common catenaries in the development, the size of which for each pulley will depend entirely upon the radius of the latter, and the coefficient of friction between it and the belt. The laws of the catenary enable us to obtain the values of v and v' in a simple manner.

Fig. 2 is taken from Weisbach's Mechanics, and shows the usual manner of placing the pulleys, which is also indicated in Fig. 1, where the dotted pulleys are supposed to be both tangent to the plumb line, respectively at A and A'. On the erroneous supposition that these points are the points of departure, this position is correct for a belt running upward in front and down behind. In Fig. 2 four positions are shown in horizontal projection. If a plumbline be hung at either a, b, c or d, it is evident that both upper and lower pulleys will be in contact with it. The position af a has been chosen for Fig. 3; the direction of the belt is indicated by arrows. By reversing both shafts the belt will shift to d, or, when one alone is reversed, to b or c. This method of setting is sufficiently correct for a shaft angle of 90°.

A model is sometimes constructed in accordance with this method of setting. It consists (Fig. 4) of two leaves of card-board, hinged together as indicated. When the leaves are open, we have the two circles, representing two pulleys, connected by an open belt with points of departure Z and Z'. By folding the leaves gradually, it is intended that the model shall represent the open belt changing through all degree of "twist" until, when the leaves are together, we have a simple cross belt, which latter is indicated by the dotted position. It is easily seen, however, that the points of departure must gradually approach each other as the leaves are folded reaching Z and Z', for the cross belt. To make this form of model represent the case correctly, some method of making the point of departure change with the angle must be devised, and also some way of changing the position of the hinge, which also should vary with the angle between the leaves.

Fig. 5 represents a model constructed in an entirely different manner. The two rollers are horizontal, and the upper one can be set at any angle with the lower. We will call this angle the *shaft angle*. The lower roller being turned by the crank, the upper one will be driven by the belt, which will find its natural position as shown. It will be found that this position, as indicated, does not correspond with that of two pulleys set tangent to a plumbline; and it will be found also that the position of the belt will be different for different coefficients of friction between it and the pulley.

We will now explain the graphical method of finding the correct position of two pulleys, as shown in Fig. 3.

We have given the radii R and R' of the upper and lower pulleys, the height h of one shaft above the other, the shaft angle, and the direction of motion of the shafts. The belt is supposed to be perfectly limber edgeways; if not so, it will run still further away from the usual position.

We make now a plan of the shafts (Fig. 3), and, as we cannot yet draw the pulleys in position, we draw the plan of two rollers or drums of the same radii (as in the model, Fig. 5). The plan of each roller will consist of two straight lines representing their outside elements, and these lines will intersect in four points a, b, c and d (as shown in Fig. 2), only two of which (a and b) appear in Fig. 3. If now we pass plane 2 through a, and perpendicular to the lower shaft, we shall cut out a circular section, represented by the semi-circle, from the lower drum, and from the upper an elliptical section, which we shall now proceed to find. Where the plane 2 cuts, the first element of the upper drum will be the vertex of the ellipse; the plan of this point is a, and we must project it to a height h above the ground line to obtain elevation a' of this vertex. The center of the ellipse will be at e', which is found by projecting e to the same height, h; e is the horizontal projection or plan of the point where the plane 2 cuts the center of the upper shaft. The minor axis of the ellipse is, of course, the diameter of the drum, and we can now draw the curve by usual methods. Having done this, we find, for convenience, a circular arc (with a center at f_2), which agrees nearly with the needed portion of the curve, and use this in place of it. We can now draw the belt tangent $z'_2\, x'_2$ (which appears in its true length), and thus obtain the points of departure z'_2 and of arrival x'_2. Projecting these back, we obtain their planes or horizontal projections $z_2\, x_2$.

In the same way we cut both drums by the plane 4, g will be horizontal projection and g' the elevation of the vertex of the ellipse, while the semi-circle will fall in the same place as before. In this way we obtain the points of departure and of arrival z_4 and x_4 in horizontal projection. Connecting these points by curves tangent at b to the outside elements of the cylinders or drums, we obtain the horizontal projection $z_2\, z_4\, b$ of the "*curve of departure*" for the upper pulley or drum, and the projection $x_2\, x_4\, b$ of the "*curve of arrival*" for the lower.

In an entirely similar way, by means of the planes 1 and 3, passed perpendicularly to the upper shaft, we obtain the horizontal projection $z_1\, z_3\, c$ of the curve of departure for the lower drum (on its underside), and the horizontal projection $x_1\, x_3\, c$ of the curve of arrival underneath the upper drum. The intersection I of the projections of the curves of departure would be the projection of the intersection of the belt planes, were it not for the slipping sideways of the belt, which throws the belt still further away from a. It is generally sufficient to make one section each side of where the belt will probably run—that is, two sections perpendicular to each shaft—and to consider the portions of the curves of departure and of arrival included between these sections as straight lines.

To allow for the slipping of the belt, we must find the belt angles for z_2 and z_4 and for z_1 and z_3. We will find it for z_2, and it is the angle, which a belt running off the upper drum at z_2 would make with an element of the drum or cylinder at the point. Evidently, $z_2\, x_2$ is the horizontal projection of the belt-tangent, and if we draw $x_2\, r_2$ through x_2 it will be the horizontal projection of a horizontal line parallel to the upper

shaft and making, with the belt-tangent, the angle sought. $z_2 r_2$, perpendicular to $r_2 x_2$, is the horizontal projection of the perpendicular of a right-angled triangle in space, of which $r_2 x_2$ is the base and the belt tangent the hypothenuse. If we revolve now this triangle about the base until it is horizontal, the vertex, projected at z_2, will go out on $r_2 x_2$, produced to z''_2, which may be found by making $z''_2 x_2$ equal to the true belt-tangent length $z'_2 x'_2$ taken from the elevation; $r_2 x_2 z''_2$ is then the angle sought.

In the same way the angle must be found for the other three planes. For planes through b and c it would be 90°.

The connection between the belt angle for the plane 2 and e_2 is quite simple, and we find e_2 as follows: Subtract $r_2 z''_2$ from $x_2 z''_2$, and divide the remainder by $r_2 z''_2$, multiply this quotient by the radius R of the (upper) pulley and divide by the coefficient of friction and the result will be e_2. In the same way find e_4. To find e_1 and e_3, R' must be used instead of R. Only e_1 and e_2 are shown in Fig. 3 to avoid confusion. We lay off e_2 from z_2 to t_2, parallel to the shaft, and draw from t_2 a line perpendicular to the shaft, this cuts the line $2ae$ and gives s_2. In the same way we find s_1, s_3, and s_4, and draw the "*curves of intersection*," $s_2 s_4 b$, and $s_1 s_3 c$, or straight lines may generally be used for the portions needed of these curves.

The intersection S of the curves of intersection is the horizontal projection of the intersection of the belt planes, which we can at once draw. Where the projections of these planes cut the curves of departure, we find Z and Z' the correct points of departure. If from these points we drop perpendiculars on the projections of the planes, we shall have e and e', the true distances that the belt slips. It is unnecessary to find the point Y, except to be able to draw the belt correctly; it has nothing to do directly with the position of the pulleys, nor is the curve of arrival of any further use in this connection.

The ordinary method of setting supposes the belt planes to pass through a, l is the distance of the upper belt-plane from a, and l' that of the lower, and these distances are what we need for setting the pulleys, and may be tabulated for the purpose. The values of e and e' show also what extra widths of pulleys are needed to allow for the slipping sideways of the belt.

Those who may be disposed to test the practical accuracy of the positions obtained as above, will confer a favor by reporting the results to me. To put the matter in a more convenient shape, tables (sufficiently accurate it is hoped) have been prepared for open belts. The shaft angles are given in the second column (headed *S A*) up to 60°; for 90°, l and l' = nothing. R', the radius of the lower pulley = half an inch throughout the tables, and in the first column, the distance apart, h, of the shafts, is given in inches; the remaining six columns are also in inches. The coefficient of friction for which the tables are calculated is one-fifth.† L and L' are quantities to be used when the coefficient is not one-fifth, as explained in the example. In testing the tables a narrow belt should be used, as no allowance has been made for stiffness edgewise of the latter.

TABLES.

COEFFICIENT OF FRICTION = 0.2.

$R = R'$

h	S.A.	l	L	e	l'	L'	e'
2	15	.65	.31	.01			
	30	.41	.26	.04			
	45	.21	.16	.07			
	60	.15	.12	.18			
3	15	.37	.20	.01			
	30	.23	.16	.02			
	45	.12	.09	.04			
	60	.09	.07	.09			
4	15	.22	.11	.00			
	30	.14	.10	.02			
	45	.08	.07	.03	$l'=l$	$L'=L$	$e'=e$
	60	.06	.05	.05			
6	15	.11	.06	.00			
	30	.07	.05	.01			
	45	.04	.03	.01			
	60	.03	.02	.03			
10	15	.06	.02	.00			
	30	.03	.02	.00			
	45	.02	.02	.00			
	60	.02	.02	.01			

$R = 2\,R'$

h	S.A.	l	L	e	l'	L'	e'
3	15	.88	.41	.01	.87	.41	.02
	30	.55	.34	.03	.52	.32	.08
	45	.35	.26	.07	.30	.22	.16
	60	.24	.20	.10	.18	.15	.26
5	15	.43	.22	.00	.42	.22	.01
	30	.27	.18	.02	.26	.17	.04
	45	.17	.14	.04	.15	.12	.07
	60	.11	.10	.05	.09	.08	.12
7	15	.23	.12	.00	.23	.12	.00
	30	.16	.10	.01	.15	.09	.02
	45	.10	.07	.02	.09	.07	.04
	60	.07	.06	.03	.05	.04	.07
11	15	.10	.05	.00	.09	.05	.00
	30	.07	.05	.00	.07	.05	.01
	45	.04	.03	.01	.04	.03	.02
	60	.03	.02	.02	.03	.02	.03

$R = 3\,R'$

h	S.A.	l	L	e	l'	L'	e'
4	15	1.04	.50	.01	1.02	.49	.05
	30	.65	.41	.02	.59	.37	.12
	45	.44	.33	.05	.36	.26	.22
	60	.23	.17	.09	.17	.11	.40
7	15	.43	.22	.00	.43	.22	.01
	30	.35	.24	.01	32	.21	.06
	45	.19	.16	.03	.16	.13	.09
	60	.13	.10	.04	.09	.07	.15
10	15	.20	.10	.00	.20	.10	.01
	30	.15	.10	.01	.14	.09	.03
	45	.10	.08	.02	.09	.07	.05
	60	.07	.06	.02	.05	.04	.08
16	15	.08	.04	.00	.08	.04	.00
	30	.07	.05	.00	.07	.05	.01
	45	.05	.04	.01	.04	.03	.02
	60	.03	.02	.01	.02	.02	.03

$R = 4\,R'$

h	S.A.	l	L	e	l'	L'	e'
5	15	1.09	.52	.01	1.06	.50	.04
	30	.72	.47	.02	.65	.41	.13
	45	.50	.38	.04	.39	.29	.32
	60	.36	.30	.06	.21	.17	.46
8	15	.50	.25	.00	.49	.24	.02
	30	.36	.25	.01	.33	.23	.06
	45	.25	.20	.02	.20	.15	.13
	60	.16	.14	.04	.11	.09	.20
11	15	.29	.15	.00	.28	.15	.01
	30	.21	.14	.01	.19	.13	.04
	45	.14	.11	.02	.12	.09	.07
	60	.10	.08	.03	.07	.06	.11
17	15	.13	.07	.00	.13	.07	.00
	30	.11	.08	.00	.10	.07	.02
	45	.07	.06	.01	.06	.05	.03
	60	.05	.04	.01	.04	.03	.05

For the intermediate values of the quantities and for other values of the coefficient we proceed as in the following example:

GIVEN:—Two shafts 6 feet 6 inches apart and at an angle of 20° with each other. The pulley on the lower shaft is 40 inches diameter, and that on the upper shaft is 16 inches, and the coefficient of friction is one-quarter.

SOLUTION.—In the tables the lower pulley is the smaller; we must therefore invert those in the example, and we must also reduce all the dimensions by dividing by 16, to bring the smaller pulley to the tabular value of one inch diameter. This will give 16 in. ÷ 16 = 1 in. or $R' = \frac{1}{2}$. 40 in. ÷ 16 = $2\frac{1}{2}$ in. or $R = 1\frac{1}{4} = 2\frac{1}{2}\,R'$. 6 ft. 8 in. ÷ 16 = 5 in. or $h = 5$ *S.A.* = 20°. We will first find l by interpolation. In the table headed $R = 2R'$ we find opposite $h = 5$ and *S.A.* = 15°, $l = .43$ and $L = .22$, corresponding, of course, to a coefficient of friction = .2. To get l for a coefficient = .25 we proceed as follows: The coefficient is to be *increased* one-quarter of itself [.20 + (.20 ÷ 4) = .25], we therefore *subtract* from l one-quarter of L. This gives (.43 − (.22 ÷ 4) = .38) $l = .38$ for a coefficient = .25. In the same way for *S.A.* = 30° we have $l = .23$ and for *S.A.* = 20° (one-third of the way from 15° to 30°) we have $l = .33$,—so that for $R = 2R'$, $h = 5$, *S.A.* = 20° and coefficient = .25, $l = .33$.

We go now to the next table, headed $R = 3R'$, and find l in the same way, except that as $h = 5$ does not appear, we find that for $h = 4$, $l = .80$ and for $h = 7$, $l = .35$; consequently, for $h = 5$, $l = .60$ (allowing something for the fact that from $h = 4$ to $h = 7$, l decreases more rapidly at first); so that for $R = 3R'$, $h = 5$, *S.A.* = 20° and coefficient = .25, $l = .60$. We have then for $R = 2\frac{1}{2}R'$, $l = (.33 + .60) \div 2 = .46$. In a similar manner we find that $l = .45$. These values are for $R' = .5$ and we must therefore multiply them by 16 and get for the distance l from the plumb-line Fig. 1, or from the point a, Figs. 2 and 3, to the belt-plane of the 40 inch pulley, $l \times 16 = .46 \times 16 = 7.4$ inches. Also the distance from a to the belt-plane of the 16-inch pulley will be $.45 \times 16 = 7.2$ inches.

To calculate the values of e and e' for the coefficient .25, we simply *decrease* the e and e' in the same proportion that the coefficient is to be *increased*; that is, we reduce e and e' in the proportion of 5 to 4. We then interpolate for the values h, *S.A.*, etc., in the given example, and find that $e = .1$ inches and $e' = .6$ inches. The smaller pulley should therefore be made an extra half-inch wider, to allow for the value of e' or an inch wider if "coned" in the center.

NOTE.—The coefficient of friction is found by weighting, say a square inch of belt resting on the surface of the pulley, and measuring the force required to make it slide slowly along; the latter number of pounds divided by the former is the coefficient sought. The surface of the pulley must be set level, and the experiment made in a direction perpendicular to its face.

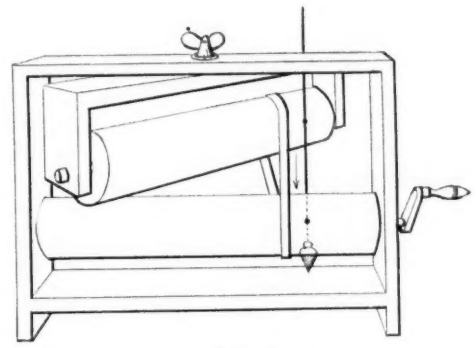


Fig. 5.

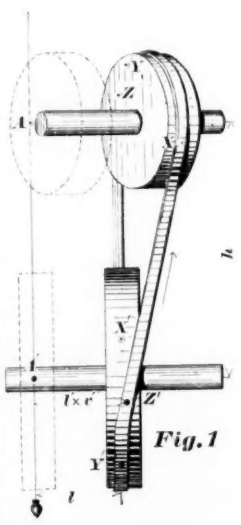


Fig. 1.

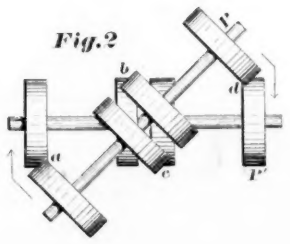


Fig. 2.

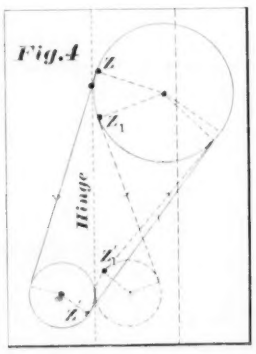


Fig. 4.

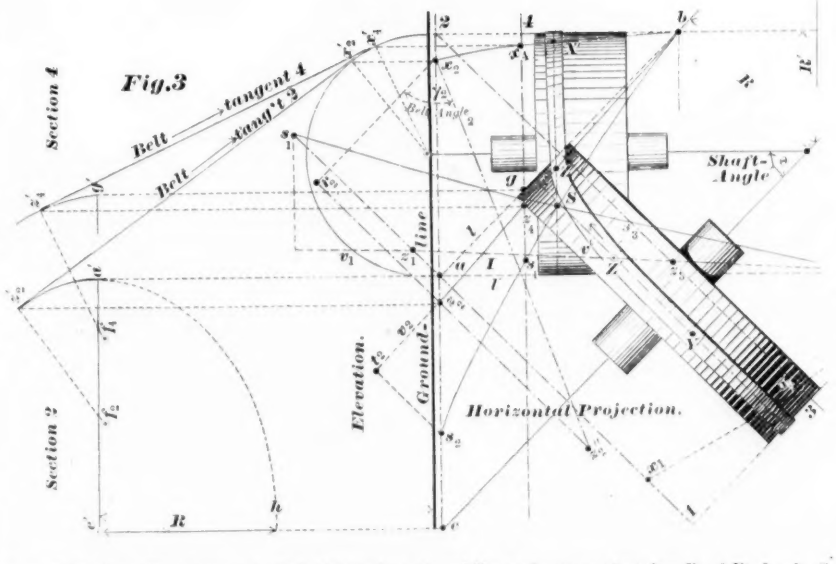


Fig. 3.

Boring Shells for Plug Cocks and Tubes for Oil Wells.

The Jarecki Manufacturing Co., Erie, Pa., have a machine for boring twelve iron shells for plug cocks at one operation, and in the same time that one could be bored. Each shell has a thread cut upon the outside at the small end of the shell, and is screwed into a chuck upon the end of a spindle. These spindles are placed in a circular frame hung upon a heavy horizontal bar or mandrel and revolve upon it. The cutters are held in small bars attached to another circular frame sliding but not turning upon the same bar, which is fed forward by feed gears. The taper holes in the shells are obtained by dropping the ends of the spindles nearest the cocks towards the mandrel. The frame is driven by gearing which also transmits a rotary movement to each of the spindles.

Another machine that attracted our attention was for boring six cast iron tubes for oil wells at one time. These tubes are about five feet long, and being cast solid have to be bored out. For this purpose twist drills of $1\frac{11}{16}$" in diameter are used and are fed up from the bottom. Six of the tubes are placed vertically within a revolving frame and the drills started at the bottom. We are informed that these drills pass through the tubes without a deflection from a straight line of over $\frac{1}{32}$ of an inch. The tubes are cast in exact vertical position, so that the center is softer than the outside, which accounts for the drill running so nearly central and in a straight line. When the tubes are cast in an inclined position the hardest part will be upon one side, while the softest will be upon the other. By putting a slight groove across each cutting edge of the twist drill the chips are broken so that they do not clog the hole. These machines were gotten up by the superintendent of the works, Mr. T. G. Morse.

An Italian Marquis sends us one hundred francs ($19.08) for the renewal of his subscription to the AMERICAN MACHINIST. We have accordingly credited the Marquis with nearly five years' subscription.

The British Steamship Glenavon recently made the trip from China to New York in 44 days and 14 hours, making an average speed of $12\frac{1}{4}$ knots per hour including three stops for coal. The total consumption of coal was 2,500 tons.

The Association of Agricultural Implement and Machine Agents, is an English society, which according to the *Ironmonger* enjoys the confidence of and works very amicably with the great body of manufacturers. "Its members comprise those who are agents pure and simple, as well as those who are also ironmongers, one of the conditions of membership being that agricultural machinery or implements worth £300, or £1,000 worth of ironmongery, together with a minimum of £150 worth of implements, shall be kept in stock."

Grinding Spherical Ended Connecting Rods.

BY A. J. SHAW, M. E.

In the shop of the Chandler & Silver Water Motor Co., at Lewiston, Me., is used a device for finishing the spherical ends of the connecting rods used in their water motors, which the writer believes to be new and which is superior to anything with which he is acquainted. It is the suggestion of Mr. J. F. Perkins, foreman of a shop in the vicinity, and is based upon the principle that lines of revolution drawn about the surface of a sphere in any direction are circles, and *vice versa*, if these circles are taken to represent cuts and are made to cross each other in constantly changing directions, the surface developed will be a sphere. In practice this condition is complied with by a revolving ring, whose axis of revolution, perpendicular to the plane of the ring, lies at an angle to the axis of revolution of the sphere operated upon, which axis is determined by the stem of the connecting rod. The process is one of "lead lapping," the ring being of lead and supplied with a mixture of oil and flour emery.

The accompanying sketch will give an idea of the device, and although the apparatus was a rough and temporary one, the results obtained were very satisfactory.

R is a collar, with a set screw *S*, held in the jaws of a chuck on the lathe spindle.

L is the lead ring, which is in halves, so that it may be closed up as it and the ball are ground away. *A* is the ball operated upon, and *C* the stem or body of the connecting rod.

P is the tool post of the lathe, and *T* a piece of wood provided with a notch in which rests the stem *C* of the connecting rod.

The ring *L* should be cut away on the front side so that the stem of the rod may swing around as shown to an angle of 50° to 60° with the axis of the lathe, and the angle of the opening *O* should be something less than the angle of the rod *C*, as it is necessary that the surface of the lap extend so far around as to pass the axis of the rod *C* extended.

The dimensions are approximate only, and may be varied considerably without affecting the results. If, however, the angle between the axes of the lathe and rod be small, it will be necessary, in some cases, to apply a light end pressure to the rod *C* to prevent a tendency to wear forward in the ring.

The process is as follows:

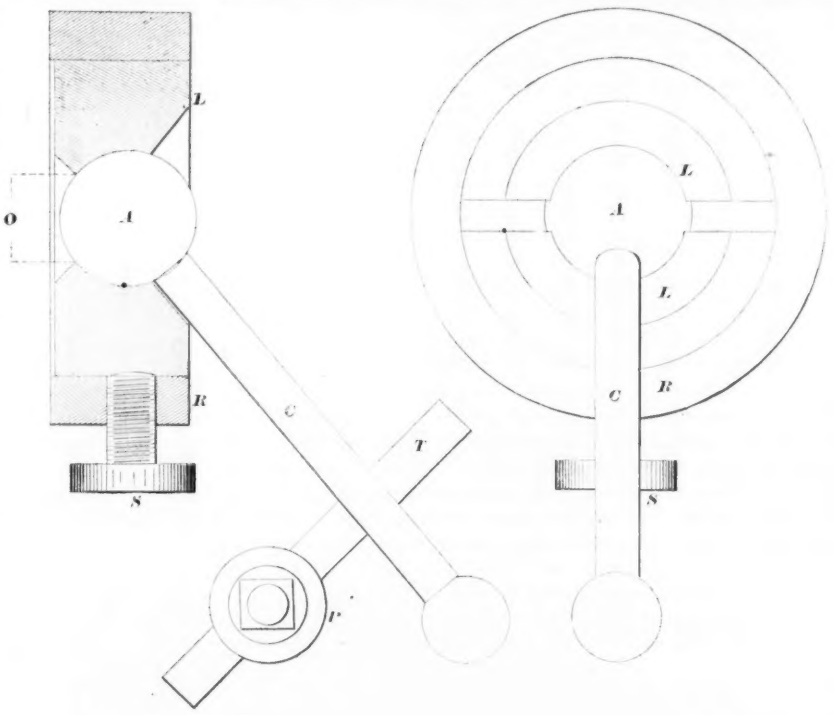
The ball is first turned by a ball-turning device similar to the one shown in the AMERICAN MACHINIST some time since, and then inserted into the ring with the stem *C* resting in the notch of the stock *T*. The ring *L* runs, at a moderate speed toward the front of the lathe, and its friction on the sphere *A* causes it also to revolve, but as the axis of the rod *C* lies at an angle with the axis of revolution of the ring *L*, each particle of emery makes a cut in a diagonal direction, on the surface of the sphere *A*, and as the revolution of the parts constantly changes the relative position of the surfaces of ring and sphere, the cuts cross each other in all directions, and as the cutting particles all move in circles, the surface produced must be that of a sphere.

A constant supply of emery and oil is fed to the ball *A*, and by its revolution is carried into the cutting surfaces of the lap *L*.

The head of the set screw *S* may be a ratchet on the principle of the star feed, and may strike against a spring stud, thrown up at the will of the operator.

It is not necessary that the center of the sphere and the axis of the lathe should coincide, as the results will be the same in either case.

The time occupied in grinding down each ball 1¾ inches in diameter, with No. 00 flour emery, the balls being turned up from steel castings with a feed of about 100 to 1 inch is about eight to ten minutes, and this includes changing and all necessary operations.



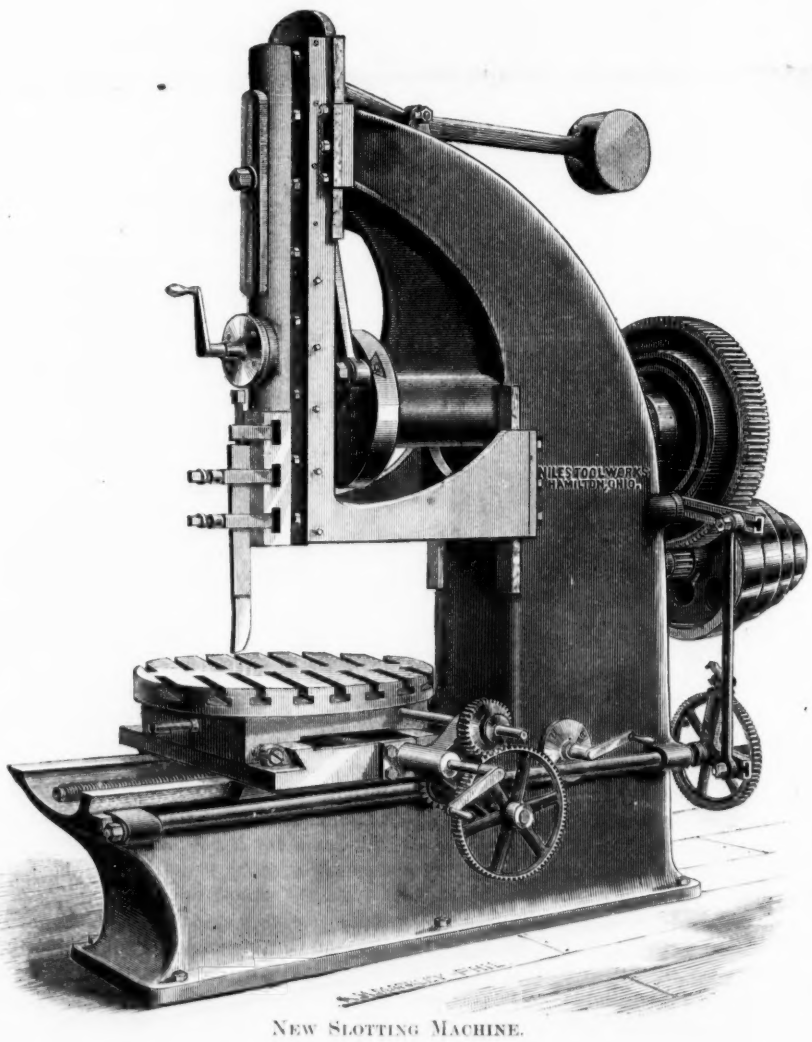
New Slotting Machine.

We illustrate with this a slotting machine, as built by the Niles Tool Works, of Hamilton, Ohio. The present illustration is of a 13″ stroke machine, but the same general features of design and construction are adhered to in the 9″, 13″ and 18″ stroke, for all of which they have recently made entirely new patterns.

This machine, which is very heavy, is, as may be seen, at the same time neat in design. It is arranged for the greatest convenience in handling, the feeds in particular being brought so close together that the operator can handle any of them from the same position.

The cutter bar has a very long bearing, which is adjustable vertically. The bearing is raised or lowered to suit the work being operated on, so that the cutter bar is always supported close to the work, which makes it very stiff and free from any tendency to spring.

The cutter bar has quick return, and is counterweighted.



NEW SLOTTING MACHINE.

The Longest Iron Rod in the World.

The longest three-quarter inch rod ever made was rolled at the Albany Iron Works yesterday afternoon. It is 263 feet long, free of flaw and plump from end to end. It is forty feet longer than any rod ever before produced in this or any other country, the next largest having been made in Pennsylvania. The manufacture was experimental to determine how long a rod could be rolled, and was conducted after careful preparation under the direction of Superintendent Williams, with Caleb Giles as roller. The rolls moved with lightning speed to carry the rod through before it cooled. The remarkable piece of workmanship is now on exhibition at the mills. If this achievement be ever beaten Superintendent Williams will try again.—*Troy Times.*

Shop Kinks.

No. 33.

BY LEWIS F. LYNE.

ANGLE PLATE FOR PLANERS.

In machine shops generally much valuable time is wasted in placing work squarely upon the platens of planers. As a preliminary operation, the rough casting or forging is first placed as nearly square as possible by the edge of the platen to allow for truing up upon all sides. A rough and finishing cut is then run over the top and down either side, after which the work is loosened and placed as nearly at right angles to the first position as possible, using a 24-inch common carpenter's square. Every mechanic who has used a square of this kind knows full well that scarcely one out of a dozen will prove to be an exact right angle, and a great many of the home-made machinists' squares are in the same fix. After running a trial cut over the work it is tested, which test, in nearly every instance, will prove unsatisfactory, so the piece must be shifted and other trial cuts started until it is found to be precisely square. The details herein described have been, and are, gone over time and again in executing different kinds of work, and upon pieces requiring great accuracy the chances of error are very serious. For instance, a slight inaccuracy in a square or a burr or ragged edge upon the work may effectually destroy the perfection aimed at in going through the different details. In fact, a small chip adhereing to the square or work is fatal to the production of accurate results.

I believe that the details here explained, when followed carefully, will be sufficient to produce a tool which may be used with implicit confidence.

The device shown at *A B*, in the accompanying engraving, represents a very simple method of constructing an angle plate which may be applied to a planer at a moment's notice and is sure to be accurate every time. This plate is first planed all over and finished so that nothing remains to be done but to plane the groove for the tongue *C* which is to fit the groove in the platen. A square cast-iron frame *D* is made with high corners—shown better in the edge view *F*. These corners were planed so as to lie flat upon the platen. To accomplish this it became necessary to turn the casting upside down several times, running a cut over the corners each time. A section of the frame is shown at *E*.

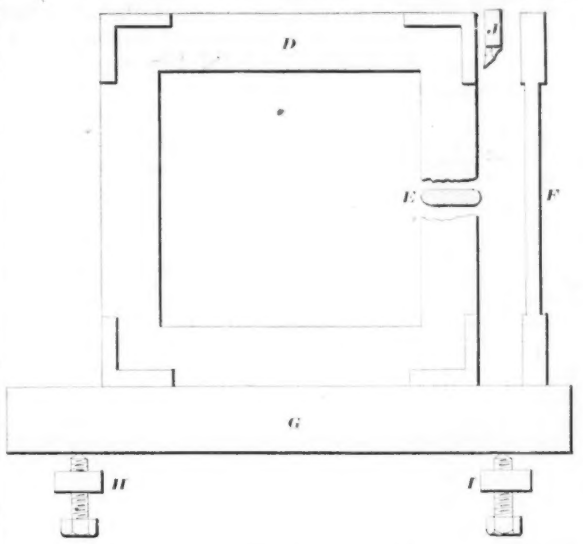
After all the rock has been taken out of the corners, the frame is placed against a bar, *G*, which is held down by a clamp at each end, and may be adjusted by the set screws *H I*, and a cut run down each side. The frame is then turned and placed as nearly square as possible, and a cut run down the other two sides; then, by turning the frame upside down with the end *D* at *G*, the error will at once be revealed by testing with the tool *J* at each end. By means of the set screws *H I* this error can readily be eliminated. These details should be repeated until the frame *D* can be turned in all positions and have the tool *J* touch either of the two sides their entire length, which will be proof that a perfect square has been produced. The frame *D* may now be removed and the angle plate *A* put in its place, with the long side *A* against the bar *G*. Great care must be taken in setting, removing all chips and burrs, and bringing the two edges into close contact. The groove is then planed to receive the wrought iron tongue *C*, which may be held either by dovetailing or putting a pin near each end.

The middle groove in the platen should be trued up to admit the tongue *C* making a neat fit.

The advantages of this device at once become apparent, and it will be seen that from

this any number of accurate angle plates may be constructed. Where there are a number of planers in a shop, the middle groove in the platen should be of a standard size to admit angle plates belonging to any of them.

No part of this process is patented, and any one has the right to use it, but Ambrose Webster, superintendent of the American Watch Tool Company, Waltham, Mass., has made a special set of tools and apparatus like the one herein described, and has placed them upon the market at a nominal price, which is probably much below the actual cost of making a single set.



ANGLE IRON FOR PLANERS.

Graduated Blower for Gas Producers.

Probably in the efforts that are being made to obtain the maximum of heat, in the form of mechanical work from the consumption of the minimum amount of fuel, the most noticeable is the change from the direct consumption of the fuel to the indirect method of first converting the fuel into gas and then burning it.

There is much to recommend the use of gas as a fuel, as its cleanliness and the facility with which its use can be regulated, in addition to which it is claimed that a material economy will result from its employment as compared with the use of solid fuel.

To successfully operate the system of gas firing, it is necessary that the plant for the production of the gas be of the simplest kind, and at the same time fulfil every requirement for a regulation of the composition as well as of the quantity of the gas produced.

While there are gas producers operated by natural draughts, it is claimed that it is essential to have a blast, for the following reasons:

The requirements to produce carbonic oxide gas from coal and other carbonaceous materials are always met when the layer of fuel in the producer is sufficiently high to allow of carbonic acid gas resulting from perfect combustion in the lower region of the producer, being recarbonized in the upper portion of the fuel bank.

It follows, therefore, that within certain reasonable practical limits the height of the fuel bank can hardly be too great. Under the most favorable conditions and with every assistance that altitude and temperature can supply, the power of chimney draught will not exceed two inches of water.

To operate a producer with this limited power corresponding conditions have to be complied with, involving a careful distribution of the fuel and an extremely limited height of bank, and this again limits the capacity and form of producer, and furthermore the quality and natural form of the fuel. On the other hand, with a powerful blast, the grate surface can be reduced and the height of the fire bank can be whatever is desired. The nature and form of the fuel can also be of any description, even of so poor quality as to produce 50 per cent. of ash, while the capacity of the producer, corresponding to its dimensions, may be kept at its maximum.

Another important consideration is that of distributing the gas to the points of combustion. When gas is produced with a natural or forced draught, holders or other more or less expensive appliances have to be provided to keep it under pressure, while with a forced blast it is made and retained under the proper pressure and simply conducted by pipes to the points of combustion.

Experience has shown that, according to the nature of fuel, the bank should have a height of from 3 to 6 feet, and for this a blast pressure of from 12 to 20 inches of water should be at disposal. When the requirements for gas are subject to variation, it is furthermore necessary to provide for means of regulating the quantity of blast, thereby making the production to correspond with the consumption, thus obviating the necessity for storage of an excessive production.

The accompanying engravings illustrate a blower designed for use in the production of gas by Schutte & Goering, of Philadelphia, Pa., in which Figs. 1 and 2 represent the blower in elevation and section.

In this blower the regulating as to quantity is accomplished by means of the different sized nozzles, 1, 2, 3 and 4, in addition to which the motion of the steam spindle has been made to correspond at all times with the motion of the air slide, by positively gearing them to one handle, as shown in Figs. 1 and 2. Besides this, means are provided for an extra throttling of the air inlets when found desirable for controlling the proportionate amount of moisture and temperature of the blast.

Fig. 3 represents the application of this blower to a battery of six gas producers at the bolt and rivet works of Hoopes & Townsend, of Philadelphia. This blower, a No. 1, works against a counter pressure of 12 to 20 inches of water, and has a graduated capacity of 10,000, 20,000, 30,000 and 45,000 cubic feet of air per hour.

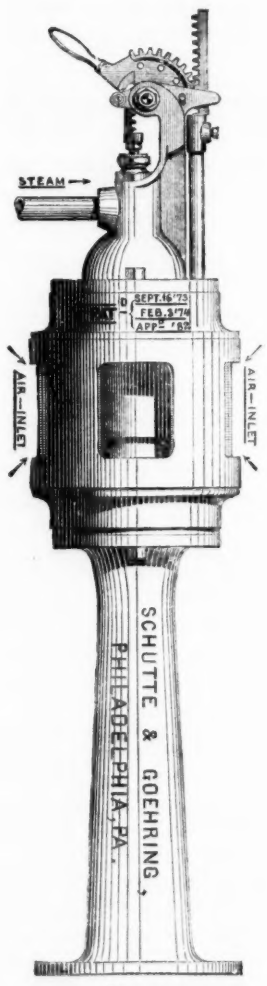


FIG. 1.

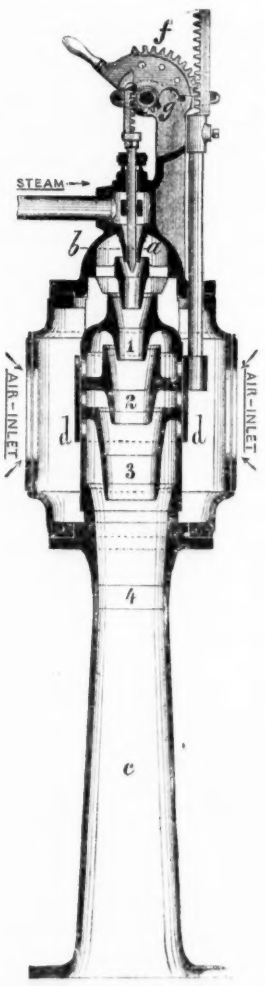


FIG. 2.

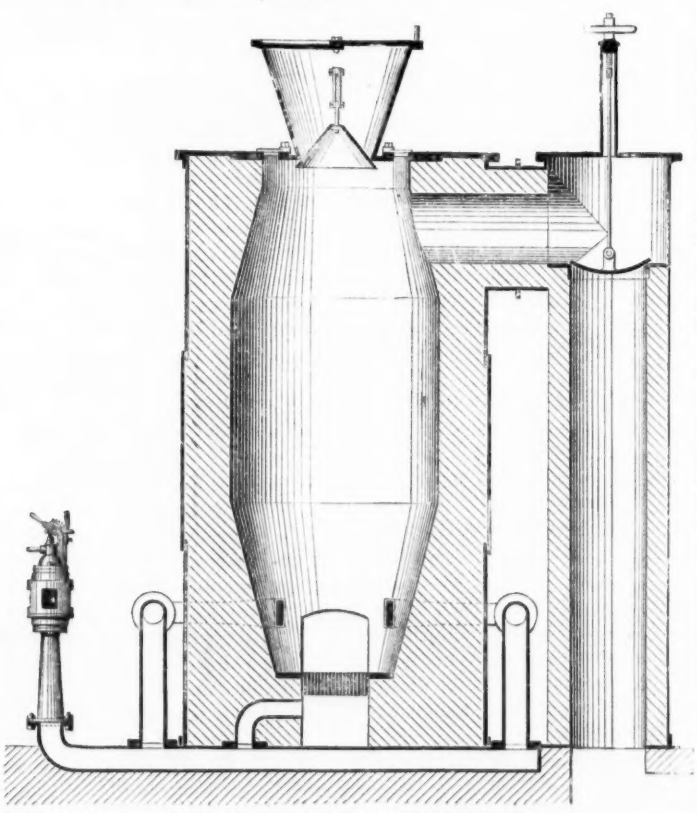


FIG. 3.

According to the *Shoe & Leather Reporter*, the leather and shoe trade is becoming more active.

LETTERS FROM PRACTICAL MEN.

Jobbing and Special Foundries.

Editor American Machinist:

Mr. Wishart, in your issue of July 1, in trying to save his credit, as he calls it, and in exercising his powers of imagination (which seem to be good) in relation to straw men, offers me an opportunity to show that there should be some difference in the management of a jobbing foundry and one devoted to special work, as in manufacturing.

I think I am not mistaken when I say that Mr. Wishart's shop is one that makes a special line of light castings, week after week. Such being the case, he knows exactly how much iron is required to be melted to have every mould poured, and have no iron left unmelted or poured out on the foundry floor. A man running such a shop as this can, without much fear of trouble, get everything down to a very fine point, as regards the least amount of fuel he can use, and when this is established he can go to his cupola men and give orders for a mixture of iron to be used throughout his whole heats, for weeks or months.

Now let us see if things connected with the management of a jobbing cupola can be got down to such a fine point. I would like to know of a jobbing foundry that—just for one week—could run its cupola without having to change the mixture of iron, and I should like to hear from a jobbing foundry that can run without sometimes having more or less iron short, or too much iron melted for the heat. I should also like to know if a shop doing a light special class of work would attempt to compare notes with a jobbing shop, as regards the number of times it has been necessary to charge up more iron towards the last of the heat, caused by some casting taking more iron than was allowed for it, or by some run-outs whereby iron is lost, &c., &c.

It would be safe to say that the jobbing shop could show twenty such cases to one of the other shop. Mr. Wishart, in his reply, acknowledges that if he had tried to melt three more such charges as his last one, his heat would have been a failure. Believing that a discussion should always be for the purpose of drawing out facts, I will now say that I think he would have experienced trouble in the melting of the three charges, no matter how much fuel he had used between them.

That I may be plainly understood, I will say that had I wanted to melt three more charges, such as my last charge of iron and fuel, it would have been successfully done. With his plan of charging, he acknowledges he could not have done it.

I would now like to ask Mr. Wishart, what would be the result of trying to run a jobbing foundry after his plan?

He had nothing to prevent his obtaining the results he did with the extra care and labor he took; but such economy as his, I think, has been fully proved to be no economy at all.

A man having a small heat to run off, and knowing exactly how much iron he will want, can with safety lessen his fuel between the charges at the expense of lowering his bed, but to do this in a jobbing shop would very often prove disastrous.

To have no misunderstanding as to what is here meant by the lowering of the bed, the following elementary explanation is offered: The bed in a cupola is the amount of fuel put in, ranging, according to the height of the melting points, from 10″ up to 20″ above the top of the tuyeres. Upon this bed the greater portion of the melting is done. This bed of fuel can be raised or lowered, when a cupola is melting properly, by putting in more or less fuel between the charges of iron. With even charging, the temperature is the highest at the regular melting point; but under favorable conditions iron can be melted above or below the regular melting point.

A cupola can be charged so as to have the latter part of a heat melted below the melting point; and in so doing, should it be ascertained that there would be a shortness in iron, there would not be much trouble experienced by throwing in 200 or 300 pounds of light scrap iron and a little fuel.

But should there be from 500 up to 1,500 pounds of iron wanted, then it would require fuel enough put in to raise up the height of the bed before going on and melting the extra charges. To do this successfully every time, I claim is, in the smaller-sized cupolas, impossible. To guard against the risk of a failure, in a jobbing foundry, we put fuel enough between the charges to keep up the bed.

Mr. Wishart, in his economy tests, depended upon what could be called the bed to do the work, as all the fuel he used between

the charges of about 4,000 pounds of iron being 175 pounds. In this way of charging, his bed must have got dangerously low when his iron was melted.

Economy of fuel is often practiced at the expense of something else, and economy in melting iron in a light special foundry, is not the same as economy in a jobbing foundry.

My friend Wishart seems to have got mixed up; the proof being that in his first article he says, my melting was a success, and in the second he joins with Mr. Kirk in trying to convey the idea that it was not a success; but, nevertheless, I shake hands with him. THOMAS D. WEST.

Cleveland, Ohio.

About Strains.

Editor American Machinist:

In screwing up bolts about engines and other machinery, the question sometimes occurs to me if it would not be better if the nuts were not forced down so tightly, and apparently an unnecessary strain put upon them? The subject was more forcibly brought to mind quite recently as I heard a foreman machinist cautioning a man about screwing too hard upon the bolts in an engine getting ready to run. As near as I can remember, he said: "The only office of those bolts is to make a steam-tight joint, and I have had enough put in, so none need to be more than moderately tight. All unnecessary strain you put on them now lessens their strength to hold the force of steam when let in."

Being acquainted with the foreman (Mr. C. O. Sine), and knowing his inclination to "argufy," I asked him if the advice he had just given his man held good in banding split hubs, driving keys, etc. His reply was that he had good reasons for saying yes. For the sake of differing with him and learning what might result from a talk with him on the subject, I made the following assertions: 1st, That as long as bands were not put on so tightly as to burst when cool, their useful strength was not impaired. 2d, That in putting a crank on a shaft and driving the key in within one stroke of the sledge of bursting the hub, does not weaken it, so far as its ability to transmit force is concerned. 3d, To screw up joint bolts all they will stand. (I don't wish to be understood as advocating this way of putting work together, for in case a shaft was to heat up very quickly a very tight pulley or crank might not be able to stand the expansion of the shaft, and for other like causes.) "Coe" said, in replying, that if my theory was correct, the strain on cylinder heads and other joint bolts was constant, with or without pressure—a theory which would be very hard for him to "tie to" until he had seen it practically demonstrated.

We could not think of any way just then that it might be tried practically, hence the only chance of coming to a conclusion was by way of argument. Continuing, he said that it was a well known fact that the front cylinder heads on the engines of a locomotive were what pulled the locomotive along one-half of the time, and as the bolts held on the heads, the pull was of course transmitted through them. If the force or strain on the bolts is the same at all times, then they could not have any influence on the pulling propensities of a locomotive. That they do, would be easily demonstrated if the facts were questioned.

He said, as he understood the subject, the banding of hubs and driving of keys were subject to the same reasoning as the strains on bolts, and he was willing to hear what could be said in supporting an opposite theory.

Before "talking back" I reminded him of a broken crank from a neighboring flouring mill which come to the shop for a new one while we were both apprentices. The engine was about a 14″×24″, the crank cast iron, and it broke about midway between pin and shaft. The pin was shrunk in and riveted, and could be used again by making the new crank a little thinner through the pin hole. The boss told me to take the piece of old crank and drill a hole through at the side of pin, and break the casting with a drift,—take the pin and put it in the lathe and fix up the end for a new rivet. Well, I began to drill, and before I got in an inch the crank cracked through one side, and from the width of the crack showed that the pin had been put in very tightly. I called "Coe's" attention to it at the time, and we both thought it strange that it did not break at the pin where so little held it, instead of in the center.

To illustrate why this crank did not break where it ought to have broken, and to substantiate my assertion, suppose we take an old pulley hub, split it in two and then shrink a band on it, having a tensile strength of 1100 lbs., and that it is shrunk on tightly enough to make a pressure on the joint in the hub of 1,000 lbs. If this hub is now put in a testing machine I think it would take the 1,100 lbs. to pull it apart. When there is a strain of 1,000 lbs. on the hub to pull it apart, the presure on the joint is just relieved and no strain added to that already on the band due to shrinking. After the pressure on the joint has been exceeded, then of course the strain comes directly on the band. As "Coe" saw the relevancy of the comparison, I do not think it necessary to explain further.

In regard to the strain on cylinder-head bolts, &c., their exact uses can be seen by referring to the action of a safety valve. For example, take a valve requiring 1,000 lbs. of force to hold it down with the maximum pressure of steam. When the boiler is cold the 1,000 lbs. force of spring or weight and lever, as the case may be, rests on the valve seat. As steam is raised in the boiler, the force on the seat is due to what ever pressure is in the boiler, showing, at least in this case, that while the force is known to be constant on the valve that on the seat is variable, and I think the principle is the same on cylinder-heads and steam joints generally. "Coe" was sorry he had not time to pursue the argument further then, but would give it his attention when he had time. He may be able to present the subject in a much different shape from which it is left. J. H. DUNBAR.

Youngstown, O.

Questions Regarding Pitch of Gear Wheels.

Editor American Machinist:

I venture to write you upon a subject of which I know but little, trusting this very fact may best serve the present purpose, which is to draw out discussion.

Why are toothed wheels pitched by their perimeter instead of by their diameter? The diameter of a wheel is certainly its principal dimension, so to speak, or as Carlyle would have said, "the principal fact about wheels."

It is the dimension dealt with in making drawings or patterns, and is the subject of a communication just at hand, in which the writer proposes for two dollars to send a table from which the diameter of wheels may be determined without computation.

Would it not be best to start with the diameter and make that the principal "fact," or in other words have each tooth represent some easy fraction of the diameter?

As a third question, What possible difference can it make what the distance may be from tooth to tooth, so long as that distance is uniform?

At Manchester, England, more than forty years ago, John G. Bodmer, the celebrated Swiss Engineer, proposed this method of basing the pitch of wheels upon their diameter. He done more. He had his patterns and wheels made in that way, and defined the pitch by Roman numerals, I, II, III, IV, V, and so on, these numbers representing the number of teeth to each inch of diameter.

In this country Brown & Sharpe adopted what they have aptly termed "diametral pitch;" and machine tool makers are forced by circumstances to use a similar method.

Before me is a wheel list of the Industrial Works, Philadelphia, in which the wheels are pitched by the diameter, so many teeth per inch. In this list the diameter column consists of whole nambers, inches, or binary divisions of inches. Another list of a San Francisco firm has the old perimeter pitch, and the diameters are simply inexpressible—are indeed impracticable.

The fourth question is, Why has not diametral pitch made more progress since Bodmer's time, and is there anything in the polygonal division of a wheel that makes perimetral pitch necessary or diametral pitch impossible for large wheels?

For small gearing, such as is employed in machine tool-making, I know practically how simple, or even indispensable, diametral pitch is. In the works here apprentices soon learn the diameter of a wheel from the number of teeth, or *vice versa*, as soon as the pitch is named. They, moreover, soon learn that the figure 2, written over the pitch, expresses the fraction in inches that must be added for extreme diameter; for example, 4, 6 and 8 pitch, written $\frac{2}{4}$ $\frac{2}{6}$ $\frac{2}{8}$, gives respectively $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ inch—the amount to be added to the pitch diameter for the whole size. The number of teeth, divided by the pitch, of course gives the pitch diameter, so that a wheel of 96 teeth, 4 pitch, becomes to workmen as simple a problem or "fact" as a shaft 96 inches long, 4 inches diameter.

Fifth and last question, Is there lurking somewhere a dark and dangerous geometrical error that renders this seemingly common sense matter a mistake? J. RICHARDS.

San Francisco, July 18, 1881.

Trial Trip of the Kaaterskill.

The steamer Kaaterskill, built for the New York, Athens, and Catskill line, made a trial trip up the Hudson on the afternoon of July 26, for the purpose of testing her machinery. This steamer was engined by W. & A. Fletcher (formerly Fletcher, Harrison & Co.), of the North River Iron Works, 267 West street, New York, under whose supervision the trial trip was made.

The hull was built by Van Loan & Magee, of Athens.

In general construction the engine is similar to that of the jet condenser beam engines of other river boats, built by the Messrs. Fletcher, several of which are well known for their speed; the usual line of feed and bilge pumps, with a Davidson steam pump for auxiliary feed, fire, and other purposes, donkey boiler, etc., with separate blower for each of the principal boilers, being supplied.

This steamer being the one hundredth built at the works, the occasion was made one of a half holiday for the workmen, who, together with a large number of invited guests, were aboard. The start was make from the foot of Leroy street, at 2 o'clock P. M., the Kaaterskill steaming to Hastings, and returning making her dock shortly after 5 o'clock.

No attempt was made to determine the exact speed, but general observation seemed to be that it was satisfactory.

Although no preliminary trial of the engine and machinery had been made, further than an hour or two at the dock, there was not the slightest hitch of any kind, such as trouble from hot journals, or other little difficulties usually incident to first trials. The engine made regularly from 22 to 23 revolutions, with boiler pressure from 40 to 43 pounds, and a vacuum of 25 to 27 inches.

The joiner work is nearly completed, and is being done in such a way as to make of the Kaaterskill, with her engines, boilers and machinery, a first-class boat of her kind.

The following are some of the more important dimensions of the boat and machinery: Hull,

Length on water line, 265 feet.
Length over all, 281 feet 4″.
Breadth at water line, 38 feet.
Breadth over all, 65 feet.
Depth of hold, 10 feet.

The dimensions of engine are:

Diameter of cylinder, 5 feet 3″.
Stroke of piston, 12 feet.
Diameter of paddle shaft, 1 foot 4″.
Diameter of paddle wheels, 31 feet.
Length of buckets, 10 feet.

Boilers, 2 in number, "lobster" return flue—dimensions of each:

Diameter of shell, 9 feet 1″.
Width of front, 11 feet 6″.
Total length, 34 feet.
Inside diameter of steam chimney, 4 feet.
Outside " " " " 7 feet 4″.
Height of chimney, 13½ feet.
Total grate surface—both boilers, 170 feet.
Total heating surface, 4,500 feet.

An Egyptian Railroad.

The dreariness of the country between Alexandria and Cairo is such that even Arabi Pasha's soldiers can hardly increase it, though they appear to have done their best toward that laudable end. The ingenious three-handed game of robbery now being carried on in the Nile Delta, the soldiers plundering the peasantry and the Bedouins plundering the soldiers, is intensely characteristic of the East. But it would require a rich booty indeed to tempt a man to remain long in such a region. From the magnificent cathedral-like depot at Alexandria right onward to the gates of Cario the country is one unbroken flat, scorched by a vertical sun, and presenting everywhere the glaring contrast of a riotous luxuriance of vegetation wherever water runs, and a barrenness like that of the Sahara itself wherever it does not. The dust is simply indescribable. Despite the Venetian blinds with which all the cars are provided, floor, wall, and roof are literally gritty before Alexandria is out of sight; and when the passengers begin to shake and brush their clothes toward the end of the journey, every car is the scene of a kind of miniature sand-storm. Add to this the assiduities of innumerable flies and mosquitoes, and the fact that the ordinary trains take four and a half hours to cover a distance of less than one hundred miles, and it will be seen that the journey is more of a toil than a pleasure.

Engineering News.

In the address of the President of the American Railway Master Mechanics' Association, at their recent annual convention, occurs the following paragraph:

"When the fact is considered that the expense of the motive-power department of the railroads of this country is above 25 per cent. of the total expense of operation, it will be seen how necessary it is for us to come to correct conclusions in matters that may come before us. Ten years' investigation and experience has enabled us to reduce the expense of maintenance of motive power by more than one-half, and I think I may safely claim that this result has been accomplished in a great measure by the investigations of this association and the diffusion of technical knowledge by the discussions at our annual meetings, and by sending our printed reports broadcast over the whole country. The railway system of this country is being developed so rapidly, and competition is becoming so sharp, that the prime necessity in railway management is economy of operation, and the man who can run his operation the cheapest, all things being equal, will steadily and surely come to the front. Bearing this in mind, it will be seen that plainness and simplicity of construction must be the watchword, ignoring everything that tends to complication, unless such complication brings about desirable results that cannot otherwise be retained. Technical knowledge in our profession is what most of us lack. Practical knowledge we have gained by long years of experience, and this association is capable and does give us the scientific knowledge we stand so much in need of."

It might be suggested that if it is essential to materially increase the pressure in locomotive boilers, it is no less so to take means to realize a larger per cent. of the boiler pressure in the cylinder. This is one respect in which the locomotive engine is behind the best practice of the day in steam engineering.

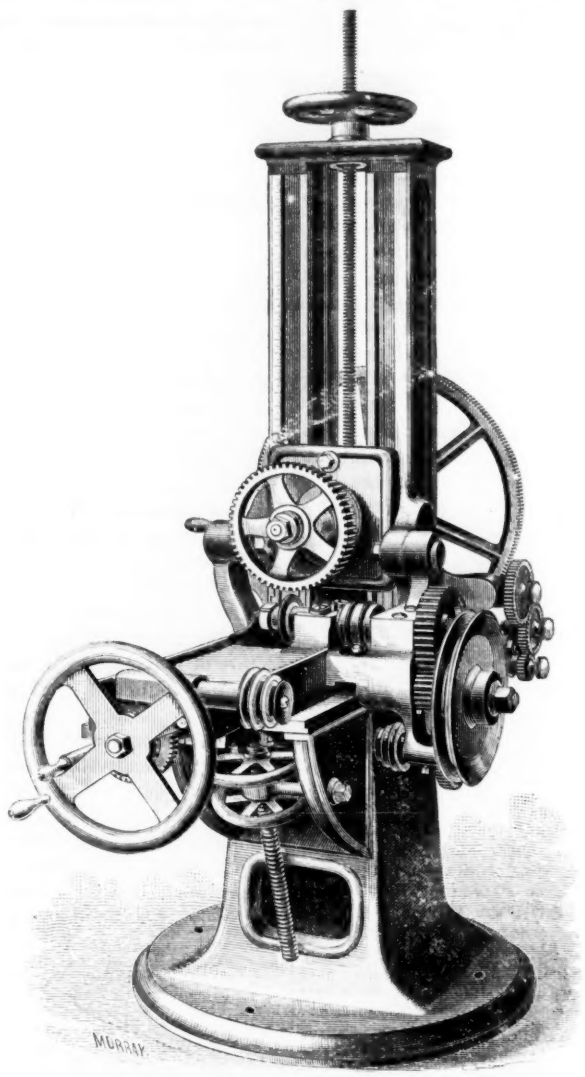
Improved Gear-Cutting Machine.

The accompanying engraving represents an improved 48-inch gear-cutting machine, as made at the Hewes & Phillips Iron Works, Newark, N. J. The machine here illustrated will cut spur gears to 42″ in diameter, of any face up to 12″; also bevel gears of any angle, and may be taken in its general design and characteristics as representative of the same class of machines up to 72″.

The cutting tool has automatic friction feed, with three changes of speed from cone pulleys, and the automatic stop motion is arranged to give a feed of any length up to 12″. The dividing is done through a wheel, the teeth of which are laid out by standard dividing machine, and finished by worm-milling tool to secure the necessary perfection.

The screws and spindles are of hammered steel, and sliding surfaces scraped.

Change gears are provided for cutting a large range of pitches.



Improved Gear-Cutting Machine.

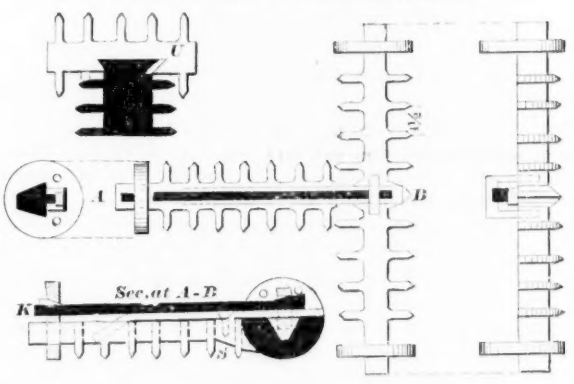
Making Return, Elbow, Branch and T-Pipe Core Arbors.

By Thomas D. West.

The making of crooked pipe castings is generally expensive compared with the cost of making straight pipes, the principal feature that increases the cost being the cores. The lower cut represents the making of a core for hot blast return pipes, the plan being that of Homer Hamilton, of the firm of William Todd & Co., Youngstown, Ohio, to whom I am indebted for permission to illustrate it. The old plan of making these cores was to make them in halves and paste them together, the halves being made in a wooden core box, or swept up on plates. Sometimes these cores were made in two sections butted together. When set in the mould as at *R*, the core irons would usually consist of wrought iron rods, spliced so as to lap by each other 3 or 4 feet, and to get them out of the casting required time, and a good deal of pulling and twisting. Some shops, for such jobs, would cast some light bars, one being in each half, and break them to get them out of the casting.

The core bar shown is all cast iron. The straight lengths are made as at *P*, which shows the end view of the bar, and also the core box having a core in it. The round holes represented are the vents. The core bar at the rounded end of the cut is also cast iron, being made of short links held together by having the projection *X* set into an opening, or between two lugs *E E*, and the rivet passed through and rivited. These links have also a guide *F F*, cast on them, so as to let the links bend inward as far as required. If it were not for these, when the arbor was set as wanted, on attempting to hoist it up the two sides would close together. For holding the other ends of the straight arbors stiffly in place the arm *W* is used. The holes are for the vent rods to pass through when making the core. This arm is put on when the arbor is put together, and is not taken off until the pipe is cast. The straight arbor on the right is joined and fastened to the end link by two hooks and a center pin. The hooks and pin are attached to the straight arbor, detached views of which are shown at *D* and *H*. At *D* is shown a side view of the center pin and one of the hooks, and at *H* the end view and the sides of the arbor the hooks are bolted or riveted to. These hooks and pin fit in holes drilled into the end of the last link, and when taking the arbors out of the casting the set screws are loosened and the arm *W* taken off. The pipe casting is then hoisted up and pounded with sledge hammers until the sand is nearly all out, then the arbor on the right is given a turn in the proper direction when it will drop out. With a little more hammering the links and straight arbor that are connected will also drop, the time and labor not being one-third of that required when wrought or cast-iron rods are used.

In making this core, the iron core box is first oiled with cheap black oil, over which a coat of thick blacking is brushed on to insure the core against sticking in the box.



Making Core Arbors.

The core sand is then put in to make a bed for the arbor to lay on, and after the arbor is bedded down solidly, the core is rammed up to the level of the box. The long vent rods are then set in their places, and to connect the vent of the rounded ends with the straight vent rods, a band or loose rope of straw or hay is laid around against each side of the links so as to come about one foot into the straight part and have them lay over the vent rods. Sand is then put on, and a piece of a box about 2 feet long, an end view of which is seen at *Y*, is placed on top and the upper portion of the core is rammed up.

The small sweep *T* is used to shape the part left open, and through which the sand is shoveled in and rammed. This section, or upper box, is then drawn and replaced until the whole top part is rammed up. For the round end, there is a short circular box used.

The top half could be formed with a sweep, but ramming it in these boxes makes a more solid core.

The core, when dried, is set into the mould by four screws, screwed into the core arbors at 2, 3, 4 and 5.

The principle involved in the construction of this core arbor is adapted to many other purposes besides making pipe.

The upper cut showing wings cast on a core arbor represents two ways of making cast-iron core arbors for a large number of *T*, branch or elbow pipes, using the same core arbors.

As a rule such castings are made with dry sand cores, and if a cast-iron core rod is used it has to be broken in pieces to get it out of the crooked casting.

With an arbor, as shown, the cores can be made of green sand, and the arbor taken out of the castings without breaking it.

The cut shows the arbor for moulding a T pipe. The section through *A B* shows the branch part connected with the main or longest section of the arbor. *K* shows a wrought iron square bar, one end of which is wedge-shaped Underneath this wedge bar is a flat wrought iron bar, one end of which is bent and cast into the arbor as shown by the dotted lines. In this bar a countersunk hole is punched hot, as a hole drilled out would have a tendency to weaken it. Through this hole a bolt or rivet is placed and cast into the arbor as shown at *S*. When taking the arbor out of the casting, the wedge bar is knocked in, when the arbor will drop out.

The cut showing a dovetail is the plan used to hold the sections together. A hard-wood wedge is driven into the opening *V*, and when the pipe is cast, the heat will loosen the wedge and free the arbor. If either of these plans are not thought to be firm enough for very heavy cores, the dovetail and bar wedge could be combined so as to make a very stiff joint. Lengthways the dovetail should be quite tapering, so that when the pipe is rolled over, the wings on the arbor will allow it to drop sufficient to permit the dovetails to be pulled apart.

The cut and description of the complete arbor is not taken from any arbor in use, but the plan is one that I think would work well and be an improvement on the old dovetail arbor, which sometimes causes trouble by getting loose.

In order to make this class of work fast, it is as necessary to have good flasks fitted up specially for the work as it is to have good core arbors. The flasks are better if made entirely of iron, as they can be cast to suit the shape of the casting wanted, thereby saving the shoveling and ramming of sand.

If the flasks are made of wood, the ends should be iron having half-circle holes, so that the round flanges at the ends of the core arbor will fill them, making a bearing of iron on iron to hold the core up and down instead of having to use chaplets. The flanges of the arbors should be no larger than the wings which hold the sand, for if larger, the arbor could not be got out of the casting.

The ends of the core box should be made the same size as the flanges on the core arbor, then when the arbor is set in the box to make the core, these flanges will have a bearing on the ends, thus centering the arbor, and when the core is set in the mould the thickness will be equal all around. A half-core box is generally used for making the bottom in green sand, and the top portion is swept up; or a half-core box is set on the top, having the upper portion cut out so as to ram the sand through, as shown at *Y* Lighter pipes, as a general thing, are made when green sand cores are used, than when dry sand cores are made in halves and pasted together. Of a lot of pipes made with dry pasted cores, the number that will have true round holes in them will be very small, while a lot made with green sand cores, made with a top and bottom box as described, will be found to have holes of the same diameter, and round.

The Board of Managers of the American Iron and Steel Association met at Cresson Springs, Pa., on the 25th inst., and adopted a call for a general convention of all iron ore producers and iron and steel manufacturers in the United States, to meet there on Thursday, September 12, to consider the duties on iron and steel and iron ore, and prepare a report thereon, to be submitted to the Tariff Commission. In the meantime, it is recommended to the various local iron and steel organizations in the country that they meet and consider the duties in which they are respectively interested.

Photographers' sensitive plates, exposed at a depth of 300 feet, show that light penetrates clear water to that depth.

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NEW YORK, AUGUST 12, 1882.

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Indications of another "boom" in the machinery trade reach us from every section of the country. Orders for machinery and tools have greatly multiplied during the latter half of July, and some shops that had nearly caught up with their orders are again obliged to book machines for delivery several months ahead. The prolonged hot weather has aided the growing crops, which were backward, to such an extent as to warrant a larger yield of corn and wheat than could have been expected three weeks ago, unless interfered with by drouth. This has given a stimulus to the demand for machine-shop work which is not likely to be lost during the remainder of this year. The outlook is very encouraging for new enterprises as well as the prosperity of old ones in the mechanical line. Railroads are likely to be good purchasers of machinery and equipments this fall, as they will have a heavy business in moving the crops.

The Mechanic as a Citizen.

"Our town seems to be 'picking up' right along," says the Rome (N. Y.) *Sentinel*. "Our iron mills are doing well and there is prospect that they will continue to do so. None of our manufactories are idle, and there are more people depending upon them than one would imagine in giving it simply a passing thought. The number of strange faces that one sees in town is large, and Romans who, a few years ago, flattered themselves that they knew the faces of nearly all the male residents of the town, are forced to confess that they know comparatively few now. These strange faces have been brought here by our manufactories and workshops. Their appearance shows that the city is growing and improving. Let us give them all a kindly welcome and encourage them to stay. They are a part of the bone and sinew of the land."

It is a strong evidence of substantial progress when the local papers of a city or village recognize not only the value of manufacturing industries in their midst but the necessity of welcoming the men upon whom the success of those industries is dependent, as important members of society. Natural advantages alone will not make a town a manufacturing center no matter how much capital is ready to help forward new enterprises. It must be a homelike place for skilled artisans. Mechanics as a class are among the most independent men in a community. Where they are met by the people of a town in the right spirit, upon their becoming residents, and are not forced to keep aloof from what is regarded as "society" by reason of their occupation, but have extended to them "the right hand of fellowship," *they stay* and the town grows rapidly in material wealth and prosperity year by year. But where they are treated with coldness and general exclusiveness by the old residents who direct local sentiment in a town, they usually make a brief stay, seizing upon the first good opportunity to move elsewhere with the hope of finding a more congenial neighborhood. There are cities and villages in healthy and attractive sections of the country that almost stand still as far as industrial matters are concerned. Few manufacturing establishments thrive where there is a feeling of social antipathy to mechanics. Small but wide awake towns, especially in the West, are offering special inducements to productive enterprises to locate within their borders and are ready to receive good mechanics, figuratively speaking, "with open arms." These towns may not have water power, or water transportation, or cheap fuel, or any natural advantages to mention, yet they are in the way of achieving an industrial prominence that will, in time, almost put to shame many older towns that have never caught the true spirit of material progress. Capital will be attracted to such places because of the extra good prospects of remunerative investment and early returns for the outlay. The local merchants and conductors of other local business interests will be well patronized which, of course, means prosperity. Occasionally there is a town where mechanics are made to feel that their presence as residents is not agreeable to the prevalent old fogy notions of the community. Retired money-lenders are probably looked upon, in such places, as the most desirable acquisitions to swell the population. The history of the industrial decay of some promising cities and villages might, if truthfully written, begin with a statement of facts regarding the social opposition to mechanics.

Points to Observe when Starting in Business.

The advice of a parent to a son about to choose an occupation was: "Beware of engaging in a business you do not understand." If this warning were generally heeded hundreds of mechanics who are now working as plain journeymen, and living in a hand to mouth way, to pay off debts contracted while previously engaged in some new business enterprise upon which failure was plainly written from the time the first step was taken, would be occupying the positions of foreman, superintendent, partner or proprietor, with a comfortable income. These debt-ridden mechanics become so by eagerly snatching at the first opportunity to engage in the manufacture of some article, or machine, or appliance of doubtful merit. Perchance they were induced to purchase stock in some wild scheme or in a machine which had not the slightest practical value.

The Keely Motor that was according to the predictions of its inventor to revolutionize the motive power of the world has failed, and its enthusiastic stockholders have been badly disappointed. The experiments exhibited by Mr. Keely were very interesting and fascinating, but to an experienced engineer it became apparent that, admitting the statements of the inventor to be genuine, there were insurmountable mechanical difficulties to be overcome before the "new force" could be used practically.

In some instances within our knowledge, apartments have been gorgeously fitted up where certain new machines were placed before the public on exhibition in actual operation. Criticism was invited and questions were asked and answered in a very plausible manner. The stock books were opened and the unwary were persuaded and induced to subscribe.

One instance in particular came under our notice where mechanics were solicited to purchase stock in a new invention which was placed on exhibition in the manner mentioned. Many of these workingmen paid their hard earned dollars for stock to fill the coffers of villains who knew at the time they received the money that the stock was valueless.

After all the stock was sold, the company was said to have started a factory in some country town and that the stock would speedily increase in value and pay large dividends.

We passed a junk shop the other day where we saw the entire machinery belonging to that company, and were told that it was bought at a sale for the benefit of the creditors.

The story of the factory was invented to enable the ringleaders of the bogus company to make good their escape. The machine in this instance did possess some merit and in the hands of a skillful mechanic, aided by honest business management, might have been a success and a public benefit. We advise mechanics to be cautious about investing their money in stocks for the reason that risks are usually very great and there is a fascination about stock dealing when once entered upon that can be dropped only with great difficulty.

Cases like the following have often come to our notice: A young mechanic saw an opportunity to go into the foundry business. The outlook seemed promising, as others in the same line of business were making money. This young man went into partnership with a moulder who was to produce the work, having charge of the practical part, while the other attended to the business management and finances.

Owing to ignorance of business, four or five thousand dollars were soon wasted and and they were obliged to stop. Another instance was that of a bright young mechanic, who started business with a lathe and drill press; solicited, performed, and delivered the work himself. In a few months he had a number of men at work for him, and was obliged to purchase more tools and enlarge his facilities. He then got the notion that he had better take in a partner with capital, so as to build and equip a large factory at once, and found a gentleman who was willing to advance the cash. The copartnership was formed, and the large factory was built and equipped. After the business was well under way the capitalist took steps to freeze out his partner, whose ignorance of sharp practice made this an easy matter, and at the end of a year the mechanic found his business and capital gone and was obliged to begin again as a journeyman.

If this mechanic had been contented to progress gradually with his business, learning it thoroughly as he went along, he would probably have been permanently successful, but the desire to become rich hastily, resulted in his financial ruin.

If a man desires peaceful rest at night and an easy conscience by day, let him refrain from speculations in a business he does not understand. A young man of our acquaintance is now engaged in paying off a debt of about three thousand dollars, incurred through speculation in wrought iron pipe. He had a good business in fitting up buildings with heating apparatus, but, seized with the mania for speculation, bought large quantities of pipe. Soon the price fell, leaving him worse than penniless. It is best to become thoroughly conversant with a business before investing money in it.

A machinist in Phœnixville, Pa., is said to have devised a valuable improvement in planers, by which the capacity of these machines will be materially increased. In the ordinary planer the cut is made only while the material is moving toward the tool holder, while by the improvement referred to there will be a cut both ways. — *Iron Age.*

This valuable improvement possesses the merit of having been made—mostly on paper—a good many times during the past twenty-five years, and will probably enjoy the distinction of being as often made during the next twenty five years. It has been put in practice at different times, particularly in England, and is perhaps used to some extent there at present, but the plan was never received with any great amount of favor either there or in this country. There are no mechanical difficulties in the way of construction, but the commercial difficulties in the way of selling a device of such limited application will probably keep it in the field of promising inventions for some years to come—say till a good many others will have an opportunity to bring it out.

Literary Notes.

POCKETBOOK OF USEFUL FORMULAS AND MEMORANDA FOR CIVIL AND MECHANICAL ENGINEERS. By Guilford L Molesworth. Twenty-first Edition, 1882, revised and enlarged. Published by E. & F. N. Spon, London, and 44 Murray Street, New York. Price $2.00.

This pocketbook was first published in 1862, as a practical pocketbook of reference for the practical engineer and mechanic. The object of the author was to divest his formulas of complexity and write them in such a way that any person having a knowledge of simple arithmetic could master them without difficulty. The work has been thoroughly revised and re-written to correspond with the advancement made in science and engineering. The class of matter presented is intended for easy reference in all practical emergencies, with full confidence that the formula has been fully tested and verified by professional as well as practical men. Every effort has been put forth to eliminate all mistakes from the calculations and as well to correct all typographical errors. The tables for strength of materials are said to be thoroughly reliable in practice and the illustrations and description of useful knots certainly ought to be appreciated by practical men who have to handle heavy machinery. Many a man has lost life or limb through the ignorance of the man who tied the knot. It is very important while tying knots securely to make them so that they can be easily untied

when desired. The mechanic and engineer should also understand tackles in order to lift or move heavy weights with the least possible help. Such information is plainly given in this book.

The regulations for construction of railways and rolling stock, together with notes on permanent way, might be more generally adopted on the railroads in this country with satisfaction.

The part relating to Hydraulics is particularly valuable on account of the comprehensive way in which it is written. This book also gives a full description of the blue print process for copying drawings, with recipes for the solutions in detail.

The "*North American Manufacturer*" which has been running for a few months in Philadelphia, has been transmogrified into IRON, (Old Series, Vol. xviii.) The letters in the engraved heading are represented as being made of flat pieces of iron or steel, filled with rivets from end to end. Except where the pieces are joined together there seems to be no use for the rivets. Æsthetically considered, however, they may mean to convey the idea that the paper is to be ornamental as well as useful.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(268) J. W., Lynn, Mass., asks: How shall I measure the pitch diameter of a bevel gear? *A.* Measure it from a point representing the beginning of the pitch line at the large end of the tooth, across and at right angles to the axis to a similar point on the opposite tooth. In other words the pitch diameter is the largest measurement you can make on the pitch lines at right angles to the axis.

(269) G. H. G., Cincinnati, Ohio, writes: In your issue of June 18, you give a process for bluing a gun barrel. Please give particulars as to what kind of oil to use; also as to method of burnishing, as I have a very fine gun and would not like to go about it until sure I am right? *A.* Use any kind of oil, as lard or sperm. Burnish by rubbing with a steel burnisher. If you have no experience you can easily polish a piece of steel and operate on that before trying to do the gun barrel.

(270) W. C., Brazil, Ind., asks: What is the safe limit in feet per second for the speed of the rim of a fly wheel? *A.* If it were possible to know all about the quality of iron and the character of the casting it would be easy to determine this with some degree of certainty. In present practice wheels are run at a peripheral speed of 130 feet per second, and sometimes at a higher speed than this, but it is always better to run them slower. Wheels to run at this speed should be of good construction, and even then it is better to run less speed. We should not recommend a speed higher than 120 feet as the limit. One trouble in getting near the safe limit is the possibility of the failure of the governor to control the speed, by which it may be so materially increased as to cause serious danger.

(271) L. M., Albany, N. Y., writes: I am studying up the expansion of steam in the cylinder of a steam engine and cannot understand why a compound engine should be more economical than a single cylinder engine with the same expansion in both cases. Will you tell me why this is? *A.* It is claimed that much of the loss in the cylinder of a steam engine is the result of the condensation of steam, due to the difference in the temperature of the steam at boiler pressure and the temperature of the cylinder at exhaustion. Also that these extremes in temperature are considerable less in their effect in a compound than in a simple engine. For instance, the high pressure, or initial cylinder, which is exposed to the temperature of the steam at boiler pressure is not exposed to the low temperature of the condenser, and the low pressure cylinder which is exposed to the temperature of the condenser is not exposed to steam of high pressure and temperature.

(272) H. C. K., Lima, Ohio, writes: Will you please give your opinion as to the best form of a tool for making ball-joint seats for steam-pipe rings in locomotive work. We are using a solid tool with cutting teeth furrowed out on the end and find it is difficult to keep in good working order on account of the teeth becoming dull, with no resort but to draw the temper and file them. Would like to make one with adjustable cutters if possible. The seats are between six and seven inches in diameter. *A.* The reamer as you describe it is such as is generally used in railroad shops. If the teeth are reasonably coarse you should be able to sharpen on a small emery wheel. Such reamers as large as you speak of are sometimes made with inserted teeth, driven in tight and further held by screws tapped in at the joint between the teeth and the body. This does not make them adjustable, and we fail to see what the advantages of adjustable teeth would be. You could, however, make them adjustable by cutting dovetail slots for the teeth, when they could be moved in the slots by means of set screws, through a collar on the stem, abutting against the ends of the teeth. When inserted teeth are used there are usually only from one-third to one-half as many as when the teeth are cut from the solid metal.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'fg Co., Cleveland, O.

F. Samuelson, Pattern Maker, 38 Gold St., N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

"Steam Economy," 124 pp., cloth, $1.00 illustrated), points out remedies for defects in engines. Best indicator practice. A. Wilkinson, 123 n. 4th St. Phila.

Mechanical Engineering.—To learn inventing, designing and construction of machinery at school. Address, S. W. Robinson, Ohio State University, Columbus, O.

We will pay 25 cents each for copies of the AMERICAN MACHINIST for January 1, 1881, which are clean and in condition for binding. American Machinist Publishing Co., 96 Fulton street, New York.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Book sent free by the publisher, Jas. F. Hotchkiss, 84 John street, New York. Mention this paper.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

Manufacturers of machinery desiring to establish works in Kansas City, Mo., should obtain particulars of Complete Iron Works, in best location, all complete for business, for rent for term of years. La Rue Smith, Kansas City, Mo.

If you desire to keep pace with the daily progress and development of Telephone, Telegraph and Electrical matters, have a copy of the NEW YORK REVIEW OF THE TELEGRAPH AND TELEPHONE sent to your address. Only $2.00 per annum. George Worthington, Editor and Proprietor, No. 23 Park Row, New York. P. O. Box 3329.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

To Machinists, Pattern-Makers and Millwrights—I have compiled the most complete table of the diameters of Pitch Line of Toothed Wheels ever published. This table supplies a long-felt want, as the numerous testimonials I am receiving will attest. The table is very complete in every particular, and from it you will get a result at a glance without calculating. No algebraic terms are used; it gives the pitch line of toothed wheels from ⅛ to 4 inches pitch, and from 12 to 100 teeth. Third edition now on the press. Orders promptly filled. Price, $2.00. Address, Wm. T. Ross, First and Washington streets, Louisville, Ky.

MANUFACTURES.

A $500,000 cotton factory is projected at Selma, Ala.

Chattanooga, Tenn., is to have a $75,000 plow factory.

Malleable iron works are building at Beloit, Wis., by Peet & Keeler.

New car-wheel works are to be established at Moorehead, Ill.

Cox & Prentiss, Cleveland, O., have adopted the name "Cleveland Twist Drill Company."

Dallas, Texas, is about to establish a $500,000 cotton and woolen factory.

J. Chatterton & Co., Cleveland, O., have built a new shop 80x30, and fitted it with improved tools for the manufacture of steam boilers.

The McMurray-Judge Architectural Iron Co., St. Louis, Mo., have just completed a new iron foundry 180x85 feet.

Out of $200,000 required to start a large machine shop at Uxbridge, Mass., to build a patent screw machine, $75,000 has been subscribed.

A fine building, 178x50 feet, is building at Chicago, Ill., for the Link Belt Machinery Company.

The Grant & Bogert Machine Tool Works, Flushing, N. Y., employ now 50 men in the machine shop and 30 men in the foundry. They are adding new tools and increasing their capacity to fill orders.

D. E. Whiton, manufacturer of chucks and light machinists' tools at West Stafford, Conn., will move to New London and occupy a larger shop. He will build his new gear cutter in the new shop.

The Kempshire Manufacturing Company, New Britain, Conn., have added to their works a new brass foundry 28x70, one story, and a new finishing room 30x60, one story, and a quantity of new machinery.

The Cummer Engine Company, Cleveland, have removed from Detroit and will soon occupy their new buildings, a machine shop 230x60, two stories, and foundry 220x60. Wm. M. Barr is the superintendent.

James Mahony, 73 Astor House, New York, has received a third order from the State Homœopathic Asylum, Middletown, N.Y., for his Universal Patent Furnace and Corrugated Grate Bars for three 54" diameter boilers.

Skinner & Wood, Erie, Pa., are quite busy in manufacturing their regular line of portable engines. They expect to build sixty engines this year, and are now engaged upon several improvements which will appear in due time.

D. F. Coughlan, Holyoke, Mass., writes us that he built the 16-foot boiler which we lately noted was being set with the Jarvis Furnace for Vernon Brothers. He has made over 30 boilers in the past fourteen years for that same firm, and as he also got the Jarvis Furnace for Vernon Brothers, thinks he ought to have some credit in the transaction, with which we agree.

The work of laying the foundations for one of the huge buildings of the locomotive works, at Garfield, a suburb of Chicago, has commenced. Two hundred men are engaged in the excavating, and the placing of the foundation stones for the west wall is nearly half completed. The dimensions of this structure are 150x415 feet. Assurances are given that the works will be in operation before the snow flies.—*Railway Review.*

Several villages in the Mohawk valley are flattering themselves upon the prospects of the West Shore railroad shops being located within their respective borders. Ilion comes to the front with the declaration that that place is the proper spot for the shops, as it is exactly half way between Buafflo and New York, and because the only really available site in the valley for such shops is to be found there. The good people of the valley should remember that the ways of railway corporations are past finding out—that villages propose and railways dispose.—*Rome Sentinel.*

The Bergen Tool Company is the name of a lately organized concern at Batavia, Ill., for the manufacture of all kinds of fine tools and machinery for special work. This company has recently purchased ground, erected substantial shops thereon, and equipped the same with new machinery and tools suitable for the prosecution of their business. H. N. Wade is president, Wm. H. Burnham, secretary and treasurer, W. D. Turner, vice-president, and Wm. L. Bergen, superintendent. Charles H. Besley, 175 Lake Street, Chicago, is business manager.—*Industrial World.*

The Montreal *Gazette* says: "We are glad to learn from what is considered good authority that Messrs. H. Disston & Sons, the celebrated saw manufacturers of Philadelphia, are about to erect extensive works in Canada, now that the policy of Protection for Canadian Industries has been practically settled as the policy of the country. This firm, probably the largest in the world in their special line, employ about 900 men in their works in Philadelphia. In starting an establishment in Canada, they contemplate not only supplying the Canadian market, but supplying as well a large part of their foreign trade from this point."

Ambrose Webster, Supt. of the American Watch Tool Company, Waltham, Mass., is placing upon the market eight different sizes and four different styles of adjustable parallel strips. These strips are intended for planer work and other places requiring parallel strips of varying thicknesses. Each of these parallel strips is made of two wedge shaped pieces, one having a groove and the other a tongue arranged to slide upon each other. All parts of strips of equal length are made to interchange. The advantages of this design are at once apparent to those using parallel strips. They are made either of steel or cast-iron as desired.

Holroyd & Co., the well-known stock and dye manufacturers of Waterford, N.Y., have purchased the well-known "Button" steam fire engine works of that place. Mr. Button has been engaged in the manufacture of fire engines—hand and steam—since the year 1834, and is justly held to have contributed materially to our knowledge and progress in such matters. We understand that the younger members of the old firm will still retain an interest in the business, but that it will be greatly enlarged; in fact that the process of enlargement has already begun by the putting on of additional mechanics, the number of which will be increased as soon as their services can be procured.

The Boston *Commercial Bulletin* says a powerful association has been formed, called the Cotton Syndicate. It is a combination of cotton spinners in Manchester, England, with American cotton growers, to build mills in the cotton states. It is proposed that the growers build the mills, grow the cotton and produce the provisions for the operatives. The Manchester Spinners are to purchase the necessary machinery and furnish the boss managers and trained operatives from Manchester for three years. They are to take bonds or stock in the mills. The growers are to furnish the cotton and pay 4 cents a pounds for spinning it into yarns for heavy goods. The cotton is neither compressed nor pressed, but goes to the cards as it comes from the gin. The growers then sell it in bales of yarn—all expenses between mill and field, and for bagging and ties, being saved.

The new improved engine lathe made by Goddard, Shaw & Co., Brockton, has many new and valuable features worthy of the notice of machinists. It is a very heavy lathe which with a 7-foot bed weighs 1,800 pounds, and carrying 3" belt, and with 17" swing. The back gears are located under the head stock, and consequently out of the way in working the lathe, and with no danger of accidents to the operator. The advantage of this arrangement of the gears is that the lathe will turn a heavier chip without trembling than lathes with the back gear in the usual place. The lead screw is entirely covered up on the inside of the lathe bed, and is thus protected from chips and dirt, and the nut coming near the center of the carriage makes a more direct pull than in any other position. The tail stock is secured to the bed by the adjustment of a cam, which is simple and effective and is easily set over by means of one screw.—*Boston Commercial Bulletin.*

Hewes & Phillips, Newark, N. J., have about completed a planer for Watts, Campbell & Co., to plane 25 feet long, 6 feet high and 8 feet wide, or by moving one of the uprights, provision for which is made in the construction, 9 feet wide. It has four tool heads, each of which has independent automatic feed in either direction. Peculiar provisions are made for oiling the ways without moving the table off, also for protecting the ways from dust and dirt. This planer complete weighs about 60 tons. They are also building on orders a number of heavy planers, amongst which is one for the Grant Locomotive Works, with 3 tool heads to plane 5½ x 5½ feet, and another for Wilcox, Shinkle & Co., to plane 5 x 5 feet. In machine tools generally, they are busy on shapers, gear cutters, and lathes up to 60" swing, two of the latter size with 24 foot beds being about ready to ship. In engine work a number of different sizes are under way to fill orders. Orders and inquiries are such as to lead this firm to expect a very busy season both in the machine tool and in the steam engine line. They are bringing out some new tools and are increasing their facilities for doing work.

Watts, Campbell & Co., Newark, N. J., are working a double gang of men, running 22 hours a day. They have recently shipped a number of large engines, some of which they are now erecting, and are at present building for the United States Illuminating Co. of New York, a pair of engines 18"x42" for the Fulton street station, for which steam will be furnished by the New York Steam Heating and Power Co.; a pair 24"x42" with a battery of five tubular boilers, each 66" diameter by 17 feet long, together with other appliances to complete the plant, for the Stanton street station, and a pair of engines same size with a battery of four boilers for the 44th street station. For the Clark Thread Co., of Newark, they are building two pairs of engines, cylinders 28"x56", each pair to have a fly-wheel pulley 25 feet in diameter, made in ten segments, with 90" face turned for four 20" belts; for the Rittenhouse Manufacturing Co., of Passaic, N. J., a 24"x48" engine; for the Celluloid Manufacturing Co. of Newark, a 24"x48"; for another concern of the same place, a 16"x38"; for the Joseph Dixon Crucible Co., of Jersey City, a 20"x48"; for the Singer Sewing Machine Co., of Cario, Ill., a 20"x48"; for Robert Adams & Co., of Paterson, N. J., a 12"x28"; for Kneedler, Hebner & Co., of Philadelphia, a 12"x28"; for Richard Fox, of the *Police Gazette*, New York, a 12"x28". In addition to steam engines they are building a 54"x30-foot planer for the Fort Pitt Foundry, Pittsburgh; a 13-foot pit lathe for the John A. Roebling's Sons Co., of Trenton, N. J.; a traveling crane for the Singer Manufacturing Co., of Elizabeth, N. J., and are filling an extensive order for sugar machinery from Cuba.

The Bridgeport (Conn.) Machine Tool Works started in August, 1880, by E. P. Bullard, the well-known machinery dealer, 11 Dey Street, New York, with the purpose of making 16" engine lathes a specialty. Eight months' time was consumed in preparatory work, at the end of which period six lathes were delivered to purchasers. The works have now turned out 180 lathes of uniform swing but of varying lengths of bed. Last spring extensive shops were purchased and the business has now assumed a permanent character. Mr. Bullard is also interested in a new 16" planer, made in Bridgeport, and now nearly ready to be placed upon the market. It embodies some special improvements.

Some months since there was shipped to Russia for the St. Petersburg Water Works, by the Geo. F. Blake Manufacturing Company, of New York and Boston, two large pumping engines of the direct-acting compound condensing type. We learn that the engines were transported, set up and put in operation inside of three months' time—two engineers accompanying the shipment and superintending the erection of the machinery. The engines are giving entire satisfaction to all concerned, and are creating considerable attention among Russian and German engineers, as they are the first large pumping engines of the kind that have been introduced on the Continent. So much for American enterprise

Machinists' and Engineers' Supplies.

New York, July 27, 1882

The supply market is quiet and no remarkable change is looked for during the next thirty days. Rumors of an advance in prices of some goods are current but none have been made as yet. Wrought Iron Pipe is stiff at 60 per cent. discount from list.

Lodge, Barker & Co., 189 West Pearl Street, Cincinnati, O., in addition to the manufacture of machine tools, are now engaged in selling general machinery. American Pig Iron continues quiet and steady with sales mostly of a retail character. We quote prices as follows: Foundry, No. 1, $26 to $26.50; Foundry, No. 2 X, $23.50 to $24.50; Grey Forge, $20 50 to $21.50. Foreign Iron and other metals same as last reported.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Situation as foreman of machine shop. Thirteen years' experience in Western States. J.E. McConnell, Iowa City, Iowa.

Two or three first-class journeymen machine pattern makers can find steady employment with Poole & Hunt, Baltimore, Md. Location pleasant and healthful.

A mechanical engineer, at present manager in a machine tool manufacturing business, will soon be at liberty and desires a position. Is well up in stationary engine, tool and general designing and construction. Address A. J., Box G, Auburn, Me.

Wanted—A Tabor Indicator in perfect working order, at once, and must be cheap. Address, P. O. box 3,306, New York City.

Wanted—A facing lathe or a boring and turning mill, either new or second hand, heaviiy built, between 48 inch and 60 inch swing, the lathe should have a compound rest. Address, Lalance & Grosjean Manufacturing Co., 19 Cliff street, New York.

HOLROYD & CO.

Manufacturers of

WATERFORD, N. Y.

Stocks and Dies,

For MACHINISTS, BLACK-SMITHS & GAS FITTERS

STATIONARY ENGINE DRIVING.

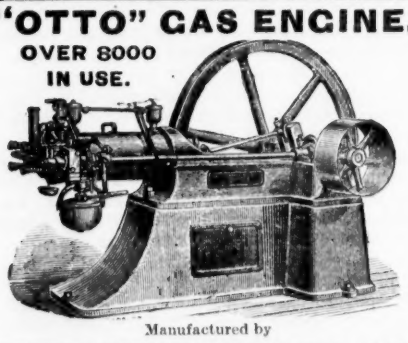
A practical manual for engineers in charge of stationary engines. By Michael Reynolds. Price, $2. For sale by Geo H. Frost, 19 Tribune Building, New York City.

T. NEW'S PREPARED ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 38 John Street, New York.

"OTTO" GAS ENGINE.

OVER 8000 IN USE.



Manufactured by

SCHLEICHER, SCHUMM & CO., 33d & Walnut Sts., Philada.

JENKINS PATENT PACKING
THE STANDARD
MAKES A PERFECT JOINT
JENKINS BROS. 71 JOHN ST. NY.

The Second Grand Exhibition Fair

OF THE

New England Manufacturers' and Mechanics' Institute

Will be held in THEIR MAMMOTH EXHIBITION BUILDING, (the Largest in the United States),

In Boston during the months of September & October, 1882.

Affording the best opportunity for advertising, or of introducing to the public new inventions. Artists, Inventors, Producers, Mechanics and Manufacturers, from every nation, invited to contribute. The product of New England's hand and brain will be well represented. No charge for space. Blank forms for application to exhibit furnished free, upon application to

JOHN F. WOOD, Treas.,
38 Hawley Street, BOSTON, MASS.

Machinery for Sale.

2 15 in. by 6 ft. Back geared, screw cutting Lathes.
2 18 in. by 6 ft. " " " " "
20 in., 26 in. and 30 in. Prentice Drills.
10 in., 15 in. and 25 in. Gould and Eberhardt Shapers.
1 No. 1 Davidson Steam Pump.
1 72 in. Cupola Bottom.
1200 ft. of 16 lb. English T Rails, with spikes, in bond.

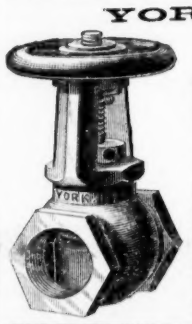
ALL OF ABOVE ARE ENTIRELY NEW AND OF BEST MAKE.

The Cupola Bottom and Rails will be sold very cheap.

For further particulars address

COOKE & CO.,
12 (Old No. 6) Cortlandt St.
NEW YORK.

DIAMOND BRASS WORKS,
YORK, Pa.



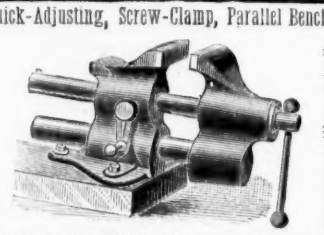
Manufacturers of the

YORK GLOBE VALVE.

These Valves, 1 inch and over, have *outside* screws, insuring great durability. Can be reground without other tools than wrench and screw driver. Can be repacked with steam on either side of valve. All Valves packed and proved before shipping. Price as low as the ordinary globe valve.

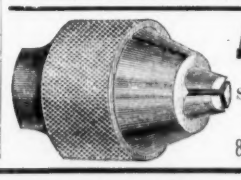
New Quick-Adjusting, Screw-Clamp, Parallel Bench Vise.

Parts interchangeable. Steel Shafts, Screw and handle.



A strictly first-class machine tool. Compact, rigid, strong, convenient

Address, JOHN THOMSON, 9 Spruce St., N. Y. City



Almond Drill Chuck.

Sold at all Machinists' Supply Stores.

T. R. ALMOND,
84 Pearl St., Brooklyn, N.Y

"THE DEANE" STEAM PUMPS FOR EVERY SERVICE.

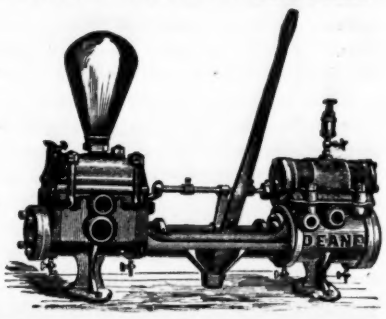
Send for New Illustrated Catalogue.

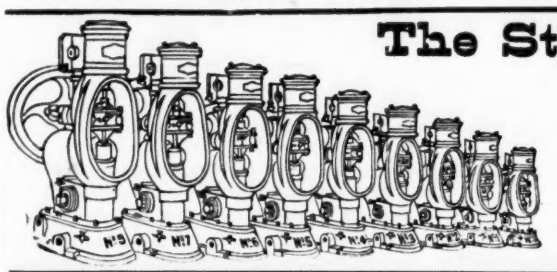
:o:

The Deane Steam Pump Co.

HOLYOKE, MASS.

92 & 94 Liberty St., New York. 54 Oliver St. Boston. 226 & 228 Lake St., Chicago.





The Steam Pumps

Made by VALLEY MACHINE CO., Easthampton, Mass., are the Best in the World for Boiler Feeding and other purposes.

Grey Iron Castings

Of superior quality for machinery and other purposes. Delivered promptly in New York. Estimates given. Castings finished when required.

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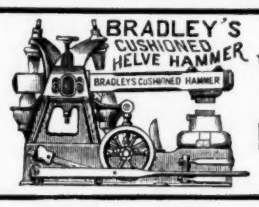

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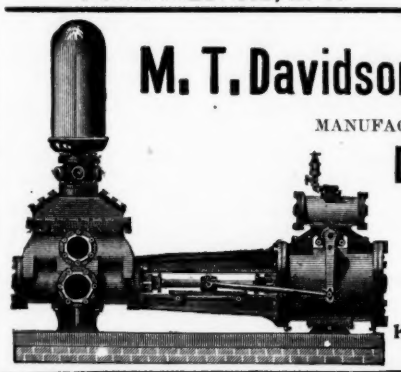

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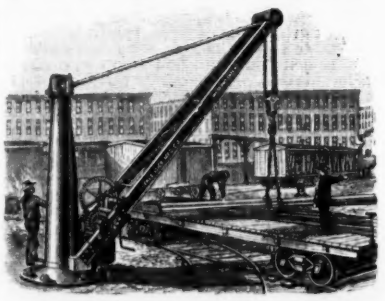

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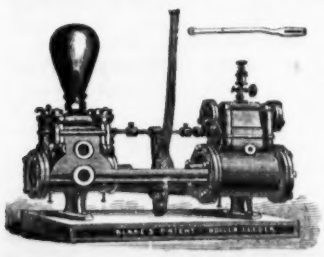

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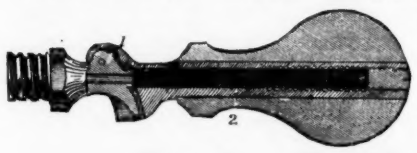

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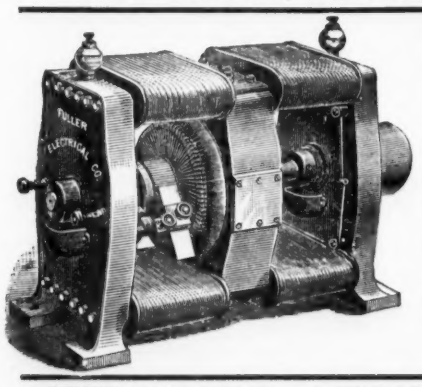

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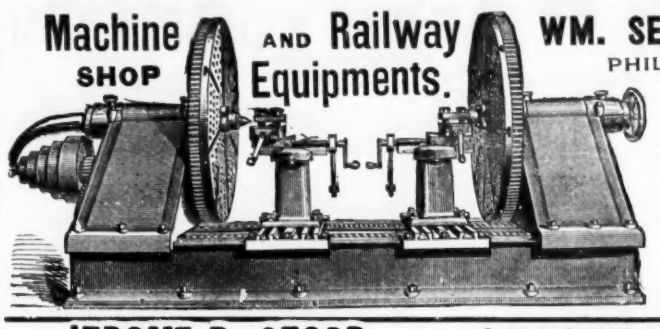

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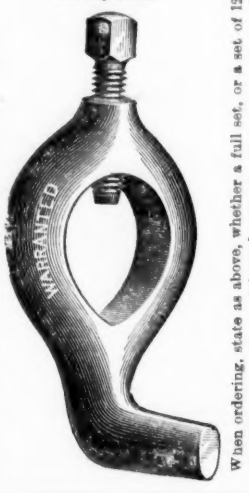

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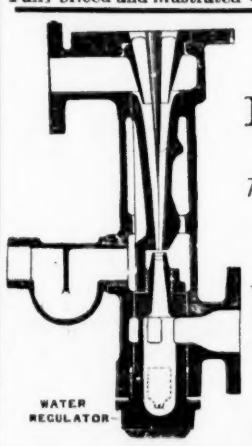

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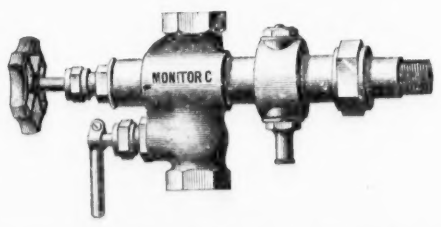

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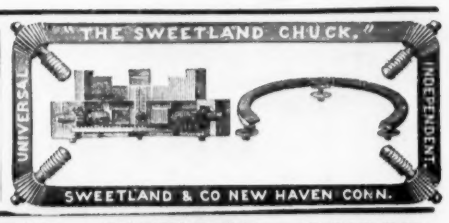

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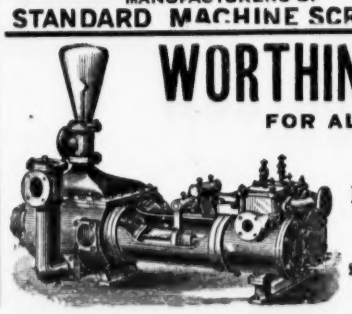

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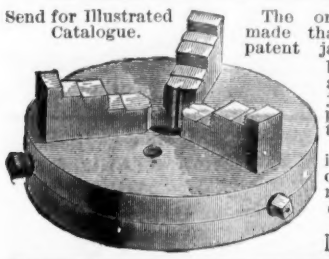

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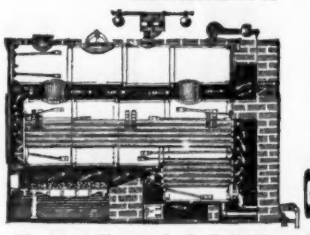

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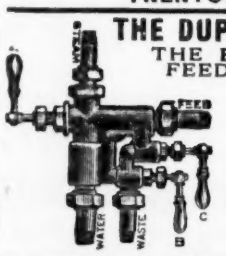

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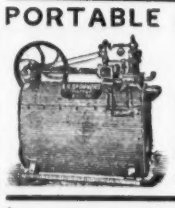

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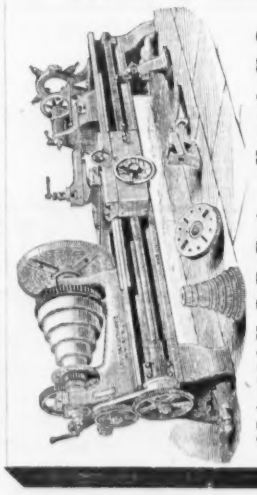

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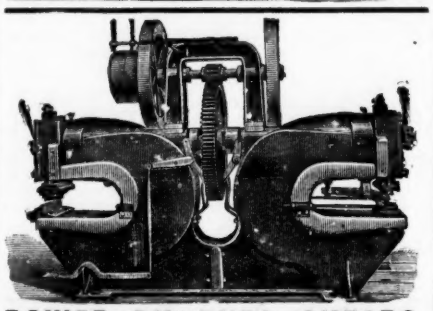

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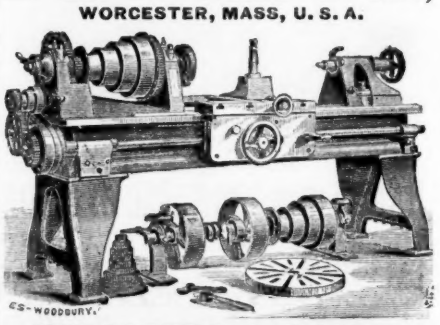

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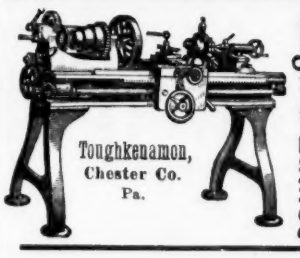

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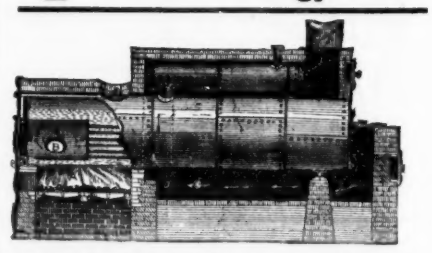

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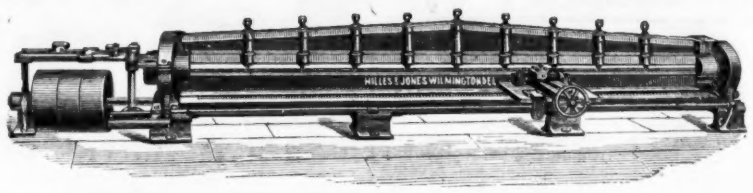

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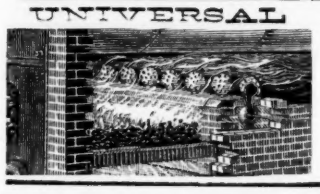

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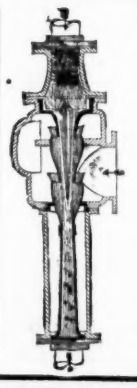

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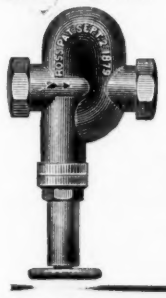

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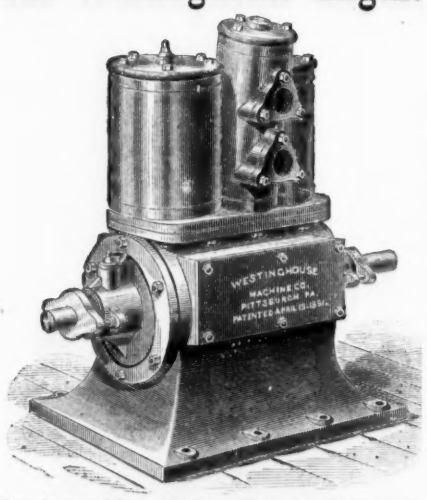

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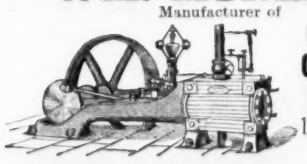

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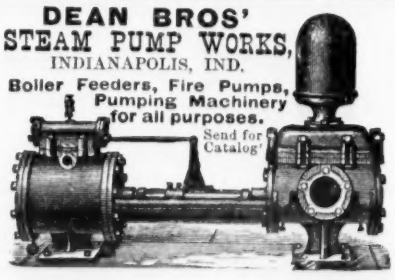

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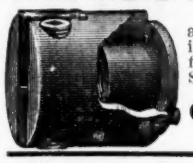

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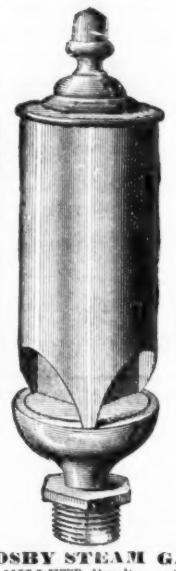

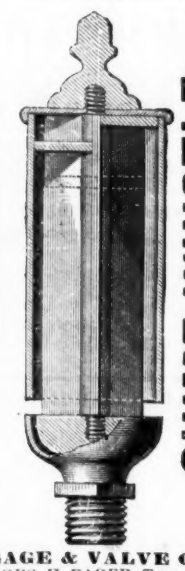

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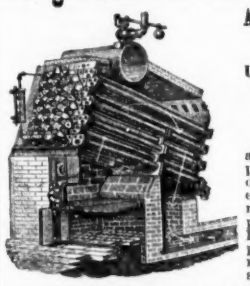

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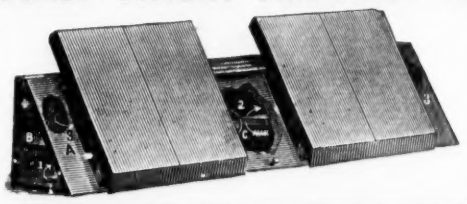

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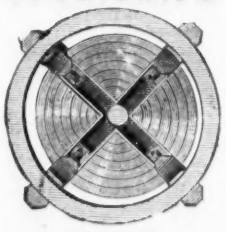

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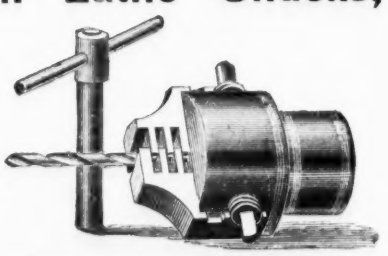

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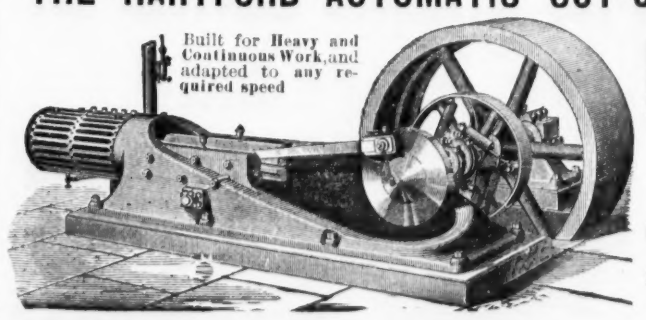

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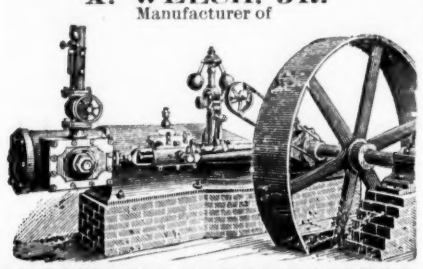

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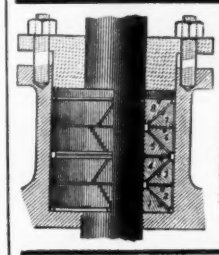

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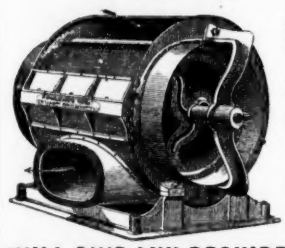

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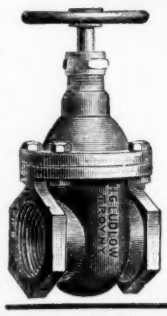

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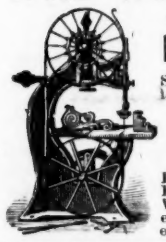

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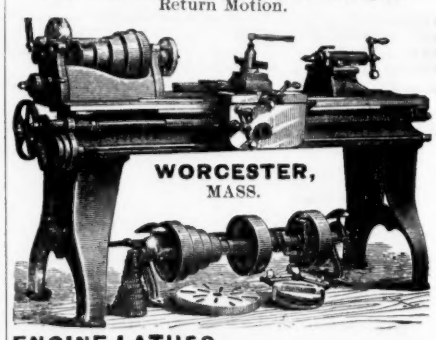

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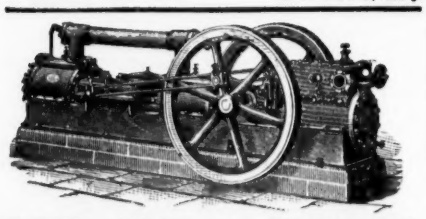

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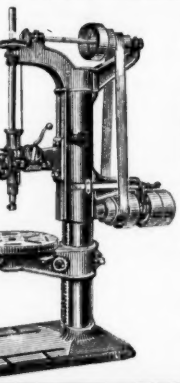

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These Shears supersede all others for ease in working, durability and simplicity.

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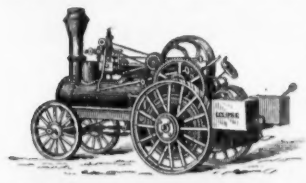

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Tapped to the U. S. and Whitworth Standard Gauges. *Adjustable* to all variations in the size of fittings. Can be *resharpened without drawing the temper* by simply grinding them. Possessing practical advantages appreciated by all mechanics. Circulars sent free on application.

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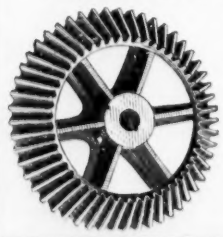

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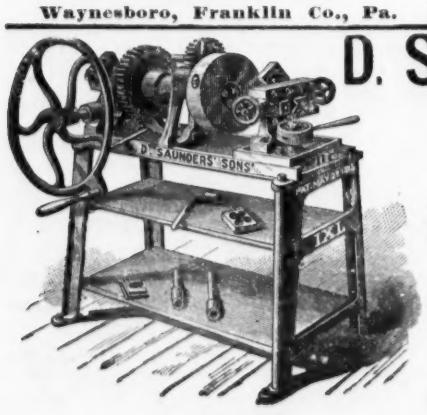

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Pipe Cutting and Threading Machines,

For Pipe Mill use a Specialty.

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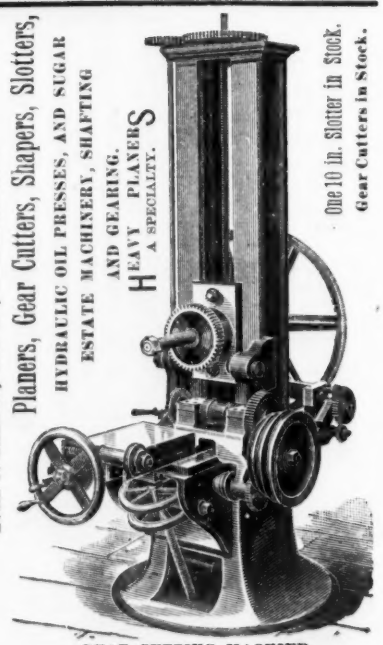

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Automatic Cut-Off,
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STEAM
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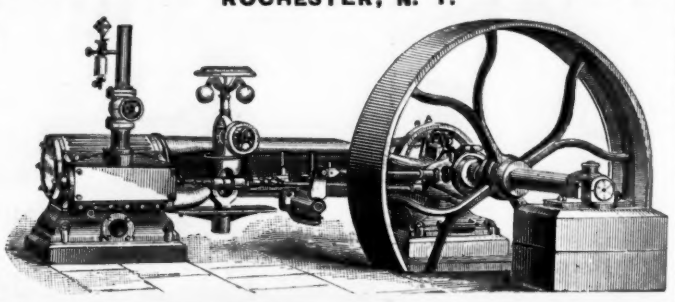

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Both Condensing and Non-Condensing, especially designed and constructed for the Rolling and Cotton Mill Trade, and all establishments requiring an absolutely uniform and economical power.

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Write for prices and particulars.

ENGINE LATHES.

38 inch, triple geared (bed to suit).			Fitchburg.
28 inch swing,	18 foot bed.		Fitchburg.
26 " "	18 "		Fitchburg.
24 " "	14 and 16 "		Fitchburg.
21 " "	12 and 14 "		Blaisdell.
20 " "	14 "		Fitchburg.
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19 " "	10 and 12 "		Gray.
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16 " "	6 and 8 "		Fitchburg.
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PLANERS AND SHAPERS.

30 inch x 30 inch x 8 foot,	Fitchburg.
25 inch x 25 inch x 8 foot,	Fitchburg.
30 inch x 30 inch x 10 foot,	Hewes & Phillips
36 inch x 36 inch x 9 ft., planer.	2d hand, good order
	Wheeler.
26 inch x 24 inch x 6 and 7 ft. planer,	Wheeler.
22 inch x 20 inch x 4 ft. planer,	Wheeler.
10 inch stroke shaper,	Fitchburg.
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60 inch radial drill, double-geared, self-feed, planed and slotted bed-plate with portable table. Best English make. Weight 4 tons.

48 inch radial drill, self-feed, double gearing slotted and planed bed. Betts.

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Copies or Tracings of any class of machinery made and used in Europe. 2000 designs **WOOD & RICHMOND,** Mechanical Engineers and Draughtsmen. 176 Broadway, N. Y.

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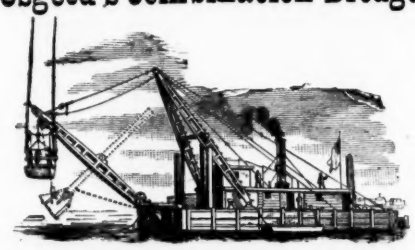

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IRON WORKING MACHINERY
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SECOR SCREW MACHINES.

WRITE FOR WHAT YOU WANT.

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NEW & SECOND-HAND MACHINERY.
JULY 25, 1882.

1	Engine Lathe,	14 in. x 6 ft.	Grant & Bogert. New.
1	" "	42 in. x 14 ft.	New.
1	" "	36 in. x 12, 17 and 25 ft.	New.
1	" "	21 in. x 6 ft.	In good order. Pond.
1	" "	18 in. x 8 ft.	" " "
1	" "	14 in. x 6 ft.	Star Tool Co. New.
1	" "	15 in. x 6 ft.	"
1	" "	16 in. x 6, 7 & 8 ft.	Bridgeport. "
1	" "	13 in. x 5 ft. & 6 ft.	Ames. "
1	" "	16 in. x6, 7 & 8 ft.	Ames. "
1	" "	18 in. x8 & 10 ft.	Lodge & Barker "
1	" "	24 in. x 12 ft.	Perkins. "
1	" "	22 in. x 18 ft.	" "
1	" "	30 in. x 16 ft.	" "
1	" "	22 in. x 10 ft.	Fifield. New.
1	" "	11 in. x 4 ft. & 5 ft.	Prentiss.
1	" "	11 in. x 4 ft.	New.
1	" "	12 in. x 5 ft.	Young. New.
1	Plain Engine Lathe,	16 in. x 4 ft.	"
1	Engine Lathe,	15 in. x 4 ft.	Plain. New.
1	Fox Lathe,	15 in x 5 ft.	Pike & Dean. "
1	15 in. x 4 ft.	Turret Lathe.	Lodge & Barker.
1	Planer,	28 in. x 28 in. x 6 ft.	A1 order
1	"	36 in x 36 in x 10 ft.	Good order. Wheeler
1	"	36 in. x 36 in. x 6 ft.	" " Harrington
1	"	16 in. x 16 in. x 3 ft.	new
1	"	24 in. x 24 in. x 6 ft.	"
1	"	26 in. x 26 in. x 7 ft.	"
1	Upright Drill,	16 in.	Prentiss. "
1	20 in.	Upright Drill.	" "
1	23 in.	"	B. G. S. F. Thompson. New.
1	24 in.	"	" Prentiss. New.
1	30 in.	"	" "
1	20 in.	Shaper.	Gould & Eberhart. "
1	15 in.	Shaper.	Hendey. "
1	Pratt & Whitney No. 2 Screw Machine.		Fair order.
	Garvin Millers Spindle Drills, &c.		New.
1	Universal Tool Grinder.		D. Slate. New.
1	Schlenker Bolt Cutter to take sizes from ¼ to 1¼ inches inclusive.		New
1	Milling Machine		A1 order. New
1	Nut Tapper, 7 Spindles.		New.
1	Hand Lathe 12 x 4, 5 and 6 ft.		New.

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THE PORTER-ALLEN HIGH SPEED ENGINE.

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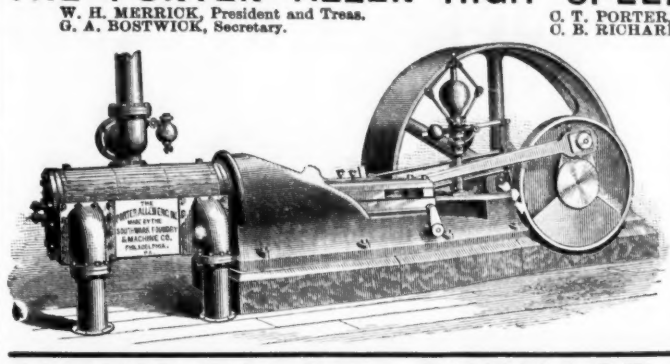

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Orders solicited for Iron and Brass Castings in the rough.

Address the Company, 430 Washington Avenue, Phila., Pa.

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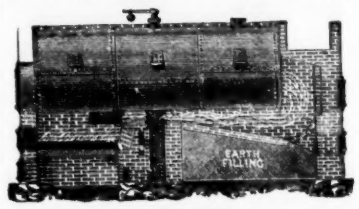

Economy of Fuel, with increased capacity of steam power. The same principle as the SIEMANS' PROCESS OF MAKING STEEL, utilizes the waste gases with hot air on top of the fire. Will burn all kinds of Waste Fuel without a blast, including screenings, wet peat, wet hops, sawdust, logwood chips, slack coal, &c. **A. F. UPTON, General Agent,**

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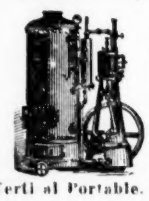
Established 1840.



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Reliable, durable and economical. *will furnish a horse power with ⅛ less fuel and water than any other engine built,* not fitted with an automatic cut-off. Send for illustrated Catalogue c. c., etc. for information and prices. **B. W. PAYNE & SONS,**

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1	Engine Lathe, 14 in. swing x 6 ft. bed. Ashton Hand. New.
1	Engine Lathe, 11 in. swing x 5 ft. bed. New.
3	" " 12 in. " x 4 ft. " New.
6	" " 11 in. " x 3 ft. 6 in. bed. New.
1	Back Geared Foot Lathe, 9 in. swing x 4 ft. bed, with Slide Rest and 2 Chucks, mounted on wooden bench. Second-hand Good order.
2	Leader Foot Lathes. New
	Briggs's Foot Lathes. Nos 1 and 2. New.
	Polishing " Small and Large. New.
1	Upright Drill, 2 Spindles. Garvin. "
1	Sensitive Drill "
3	Light Drilling Machines. "
	A full assortment of Lathe Attachments, Countershafts, Chucks, Drills, &c., &c.

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IRON PLANERS,
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A GENERAL LINE OF

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Complete List of Tools for Quick Delivery Furnished on Application.

PARTIAL LIST OF TOOLS ON HAND,

40	inch	swing,	12	foot bed,	Triple Geared Gleason Engine Lathe.
28	"	"	26	" "	Ames Shafting Lathe.
26	"	"	25	" "	Powell Shafting Lathe.
26	"	"	20	" "	" Engine "

Iron Planers.

27 in. x 24 in. x 6 ft.	Pond Second-hand.
24 in. x 24 in. x 6 ft.	Hendey Machine Co.
22 in. x 20 in. x 5 ft.	Wheeler.
30 in. x 30 in. x 10 ft.	Whitcomb Mfg. Co. Planer.

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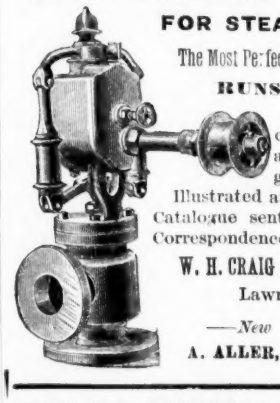

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RUNS IN OIL.

Guaranteed to accurately regulate all classes of engines.

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PROMPT DELIVERY.

One 12 inch Cylinder. 36 inch Stroke. At once.
One 14 " 36 " In two weeks.

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Second-Hand & New MACHINERY.

Aug. 1, 1882.

The following New and Improved Machinists' Tools are part of what we have for early delivery

1	42 in.	Swing,	16 ft.	bed.	New Engine Lathe. Aug. 10
1	36 in.	"	12 ft.	"	" " 1
1	22 in.	swing,	13½ ft	Bed	Engine Lathes.
1	26 in.	swing,	14 ft.	bed.	Aug. 1st.
1	26 in.	"	16 ft.	"	" New.
2	26 in.	x 7 ft.	Planers.	New.	Aug. 1st.
1	32 in.	x 8 ft.		"	Sept. 1st.
1	38 in.	x 10 ft.		"	Aug.
1	38 in.	x 12 ft.		"	"

The following on hand:

1	22 in.	swing,	11½ ft	Bed	Engine Lathes. New.
2	22 in.	"	12 ft.	"	"
4	19 in.	"	8 ft.	"	" "
1	19 in.	"	10 ft.	bed.	"
2	18 in.	"	8 ft.	"	"
1	18 in.	"	11 ft.	"	" Tilting carriage.
5	15 in.	"	6 ft.	"	" New.
1	Square Arbor Fox Lathe. New.				
1	15 in.	swing,	9 ft.	Hand	Lathe. New.
3	12 in.	"	6 ft.	"	" "
1	10 in.	"	4½ ft.	Bed	Hand Lathe. New.
2	30 in.	x 8 ft.	Planers.	New.	
1	26 in.	x 26 in.	x 6 ft.	Planer.	New.
1	22 in.	x 4 ft.	Planer.	New.	
2	38 in.	Swing Upright Drills.		B. G. & S. F.	New.
1	26 in.	Drill.	B. G. & S. F.	New.	
1	18 in.	Bench Drill.			
1	2 Spindle Drill. New.				
1	4	"	"	"	
1	3	"	"	Second-Hand.	
2	4	"	"	"	
2	Wall Drills, heavy.		Second-hand.	60 in	
2	12 in.	Shapers.	New.		
2	15 in.	"	"		
1	Pratt & Whitney Hand Miller.				
1	Sellers Milling Machine.		2d-hand.		
1	Face Milling Machine.		Second-hand.		
1	Pond's Double Milling Machine.		2d-hand.		
1	No. 2 Screw Machine.		Wire Feed.	New.	
1	No. 1	"	Brown & Sharpe.	2d-hand	
1	Screw Head Slotter.		Second-hand.		
3	Second-hand Profiling Machines				
2	4½ in	Hyde's Patent Centering Machines.		New.	
1	Emery Grinder.	2d-hand.	for 10 in. Wheels.		
1	Bolt Pointing Machine.		Second-hand.		
1	Double Nut Tapper.	New	Horizontal.		
1	Horizontal Boring Machine, 10 in. Swing.		2d-hand.		
1	Betts, No. 2, Power Punch		New.		
3	Double Acting Presses, No. 3, nearly new.				
4	Single-Acting Presses, for power,				"
100	Foot Presses, nearly new.				
1	Medium Power Punching Press.		Second-hand.		
2	Small "	"	Presses.	"	
1	Foot Punch, with bench.		New.		
1	Lot Pistol Machinery.		Second-hand.		
4	Grind Stones and Frames.		New.		
1	Steam Hammer.	Cylinder 6½ x 12.	2d-hand.		

Lot of Forges 1 Railway Saw Bench, 1 Foot-power Circular Saw.

Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in store.

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BROWN & SHARPE MFG. CO.

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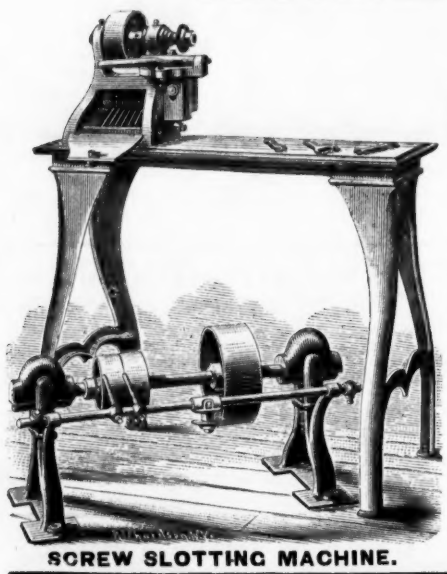

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This machine, as will be observed by an examination of the cut, is very simple, and is well adapted for slotting studs and screws expeditiously. Duplicate bushings, suitable for different sizes of screws, can be fitted to the clamping jaws. The machine contains a closet, in which is a rack for holding the various sizes of cutters, and also furnishing a place for bushings, wrenches, &c. Counter-shaft should run 160 turns per minute. Tight and loose pulleys 6 inches diameter, 2½ inches face. Weight of machine, with countershaft, 370 lbs. Price, with everything in cut, $90.

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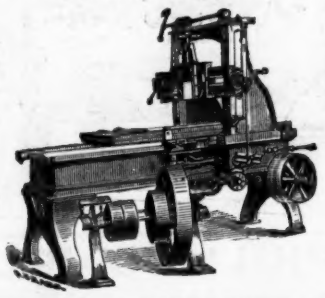
MACHINISTS' TOOLS,

GUN AND **Sewing Machine Machinery.**



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16 x 16 to 48 x 48 inches square, and various lengths. All feeds automatic.

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DROP FORGINGS

Of Every Description, from 1-16 ounce to 30 lbs. weight, for

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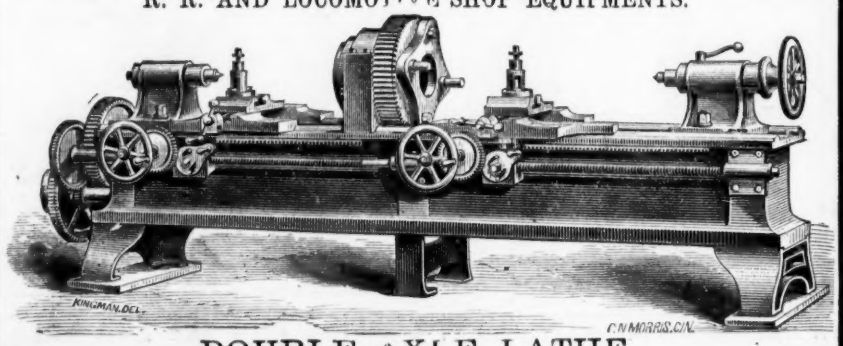

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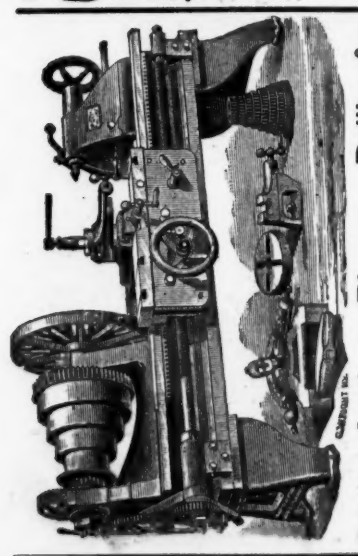

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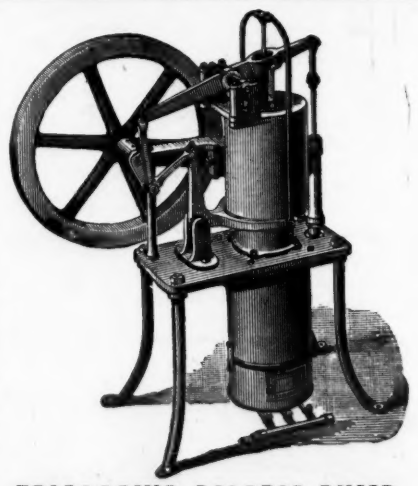

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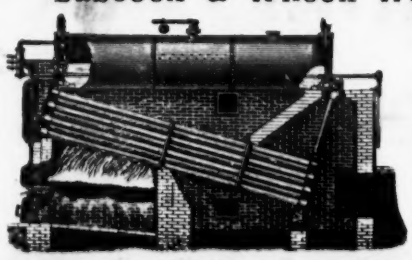

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